agriculture

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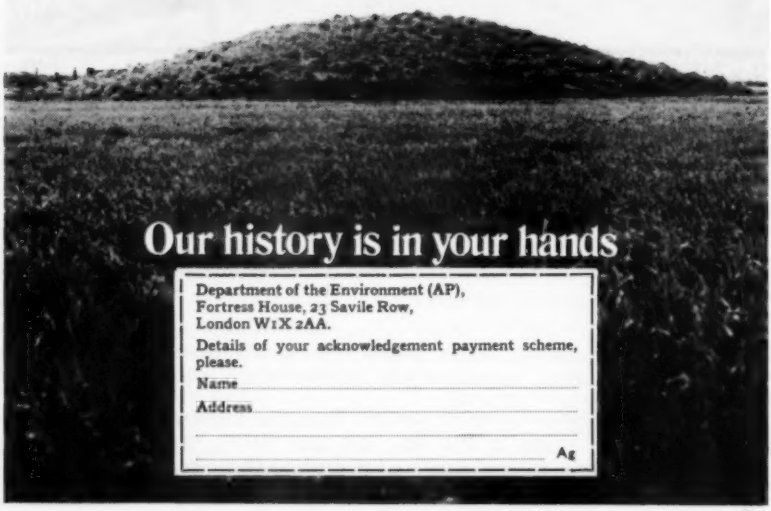

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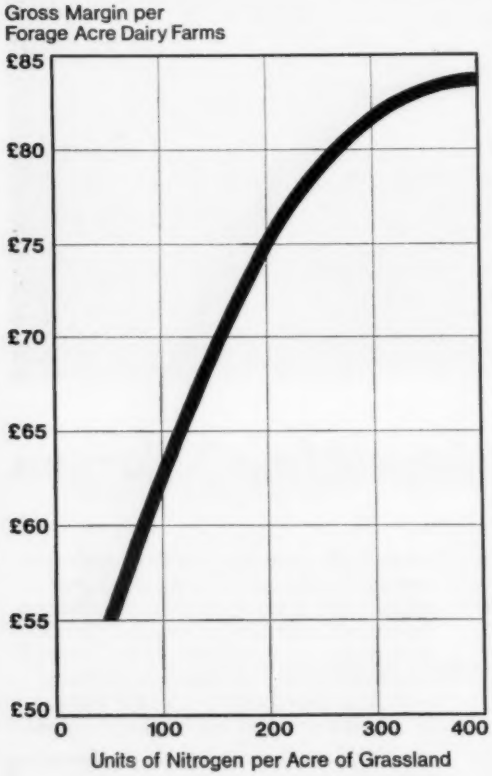

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Agriculture

VOLUME 79 - NUMBER 10 - OCTOBER 1972

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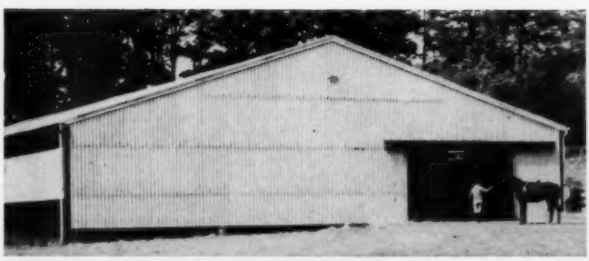

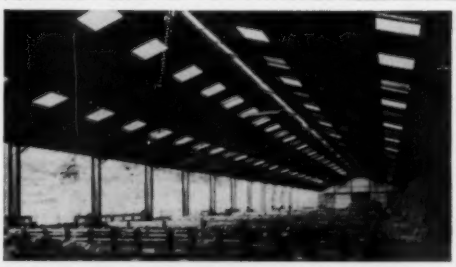

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(037)

The Poultry Departments' Newcastle Disease Research Unit at the Central Veterinary Laboratory, Weybridge

Virus infection of poultry can spread rapidly. Steps are being taken towards more effective

Newcastle Disease Control

W. H. Allan

NEWCASTLE disease is a virus infection remarkable for its very high degree of contagion, the many forms that it can take and its widespread nature. It is not as ubiquitous as Marek's disease or infectious bronchitis, nor in non-epidemic periods as economically damaging. The chief risk is that more virulent strains of the virus appear from time to time which can infect and spread through a country's poultry population with extreme rapidity. When this happens, entire units of poultry may die and the virus they excrete while infected can be spread to other units by the airborne route, on infected birds, on crates, in litter and on the clothing of personnel who move from one unit

to another. At the height of an epidemic, the virus will infect units so heavily that, unless extra precautions are taken during cleansing and disinfecting, the next crop of birds is very liable to be infected at such an early age as to render any attempts at vaccination of little value.

When infection takes place in relatively isolated units the best solution is to isolate the unit from all other poultry, depopulate, clean with vigour and restock only after effective disinfection. This is made even more effective if the unit is then left empty for several weeks. In such circumstances the chance of re-infection is low. In intensive units close to large concentrations of poultry the chance of infection from elsewhere becomes much greater. In the large consortia, in which most broilers are reared these days, the opportunity to segregate and leave a unit empty is reduced; where placing chicks from a hatchery is computerized to give the maximum stocking within groups, single or multiple cases of disease may not be allowed to affect the programme of restocking.

Control by vaccination

For economic reasons vaccination of large numbers of birds often has to be by mass methods using live virus vaccine which has some effect on the respiratory health of the birds. In periods when maximum productivity is required from broiler crops, such vaccination is rather unwelcome and the temptation to cut down or avoid it increases. As the apparent disease threat lessens, the temptation becomes greater and after a period of quiescence large groups of birds are likely to have been left fully susceptible to disease. In effect, competitive pressures within the industry tend to favour conditions in which a fresh introduction of virulent virus has the best chance of sweeping through the poultry population.

While veterinary surgeons cannot approve of such intermittent methods of control, we recognize the commercial pressures which bring them about and are developing the most satisfactory control methods acceptable at all periods and not just at the height of an epidemic.

Vaccination methods

Prior to the epidemic which started in August 1970, only the inactivated vaccine was used in this country. The laborious task of individual inoculation of large numbers of birds made effective vaccination slow and difficult. With the introduction of the B_1 and LaSota live vaccines, administration in the drinking water speeded up the process of immunization. This method has been found to be fully satisfactory on some units, but on others the technique has not been applied sufficiently well to give uniform results. One difficulty is to ensure that all chicks can drink an adequate amount of vaccine-containing water without stressing them by water deprivation. Impurities in the water itself or in the drinkers or water systems have led to problems in some areas.

While these difficulties may be satisfactorily overcome by application by the eye drop method, this is a return to the slower individual method, and while it is highly successful on smaller farms it is too laborious to be used routinely on the larger units. To overcome this, the spray or aerosol method of application has been developed. It consists of suspending a 1,000 dose vial in a small amount of water and spraying this over the birds in droplets

either by a hand-operated pump or by dissemination with an electrical generator which throws out a mist.

The droplets may have an initial diameter of 1–60 microns in the wet state. However, as soon as these come in contact with the atmosphere they begin to dry out, so that very quickly the vaccine is suspended in the air as dry droplet nuclei until inhaled by the chicken. Knowledge of what happens when the nuclei are drawn into the chicken's respiratory tract is incomplete, although there is evidence to suggest that the larger nuclei with diameters of 5–10 microns tend to lodge in the upper respiratory tract while the smaller are drawn deeper into the lungs or the air sacs where they may set up a more severe reaction. This, in turn, may lead to complications such as a generalized coli septicaemia.

We know that droplets of varying ranges of size are produced by different types of generator, and that it is important to use very pure water to avoid chemical inactivation of the vaccinal virus during the evaporation phase of the droplets. What is not yet certain is whether the technique can be improved to the extent that it is effective and fully safe for all birds. It has, however, the advantage of inducing a rapid rise in the protective antibody levels and is easy to use; large numbers of chicks of all ages can therefore be vaccinated quickly if the occasion arises.

Precautions for operators

It is important to stress that these virus droplets are inhaled by the operators as well as by the chickens unless proper precautions are taken.

All people involved in such vaccination must wear a full face gas mask, properly fitted to make sure it is leak proof and with an activated charcoal filter renewed periodically. Failure to have such protection when a vaccine cloud is present may lead to conjunctivitis or to influenza-like symptoms. In rare cases in people with an allergic tendency, or with a history of asthma, inhalation of the vaccine may cause a much more serious reaction in the lungs. Such people must avoid all contact with this vaccination process.

Factors affecting control

Achieving control of disease is relatively straightforward where poultry are kept in small numbers of one age in areas in which the general poultry population is low. As numbers on broiler sites has increased over the years from 5,000 to 500,000, the chance of infection being introduced on to any one site has increased. With the larger numbers, both the placing of chicks and the removal of birds at the end of a crop may have to be staggered because of limited capacity at the hatchery and packing station. This has the inevitable result of the operation progressing towards one of continuous stocking.

It cannot be stressed too much that lack of total depopulation is the main factor which leads to the maintenance of disease, be it Newcastle disease or infectious bronchitis. Once such disease is introduced into a continuously stocked unit, it is very difficult to eradicate; it may well be that the economic advantages of such units, from the pure husbandry point of view, become a financial liability in terms of poor disease control. Units of this type not only retain infection on the site but also provide a nucleus of infection for other units in the group and neighbouring farms.

Large placements also increase the likelihood of chicks being brought in from areas in which a different disease picture exists; although such movements are of clinically healthy birds, there is always the risk that birds incubating disease are introduced accidentally.

On large sites disease will spread from house to house, usually from the air outlet to an adjacent air inlet or on the boots and clothing of the attendant. When birds are immunized so that the amount of field virus present is kept to a minimum, such transfer may be slow and erratic or may not take place at all. If the birds are unvaccinated, then virus such as Essex '70 will move from house to house with little or no impedance. The layout of sites so that houses lie parallel to one another increases the rate of spread; and during the removal of birds or litter there is considerable introduction of contaminated material to houses either with uninfected stock or, worse still, to houses cleansed and disinfected for the next crop of birds.

To achieve control of this type of spread, there has been a growing interest in the use of glass fibre filters to cut down or remove the introduction of infection. The problem now is to find a filter material which is inexpensive and yet can remove infected material without becoming blocked or impeding the air flow so that the power of the ventilating fans has to be significantly increased. When a satisfactory material can be developed, its use will provide a significant improvement to disease control.

The removal of litter, whether infected or not, is a growing problem and another advance to assist the industry would be a successful method of gassing litter with a disinfectant such as methyl bromide. One consideration, here, is to have enough houses which can be rendered sufficiently gas tight for the technique to be worthwhile.

The main defence against the disease must, however, remain an adequate programme of vaccination to prevent the build up of numbers of susceptible birds that can give rise to a fresh upsurge of the disease.

Maternal immunity

In all species, antibody from the dam is transferred to the young to give some protection in the first few weeks of life. In the bird, this is by the transfer of antibody through the yolk sac from which it is absorbed in the later stages of embryonation and which is completed soon after hatching. This maternally derived antibody is short-lived in the young animal and its effective duration is dependent on the titre or concentration that it receives; thus in the progeny of birds which themselves have very high levels of antibody, as a result of field infection, the high titres that are transferred are likely to persist for much longer than those from a dam that has only moderate levels of antibody derived from some previous vaccination.

Prior to the 1970 epidemic, it was known that high levels of such antibody could interfere with the vaccination of young birds up to about twenty-one days of life: during the field trials in East Anglia the concentrations of such antibody were measured again and it was found to our surprise that there were now some birds which had levels so high as to persist until the growing bird was forty-two days of age or more. This made the problem of vaccinating some groups of young chicks much more difficult. In addition to this, it was confirmed that the levels of antibody varied a great deal from chick to chick within the same flock, and even more so in the progeny from varying parent flocks. Studies showed that the concentrations of such antibody fall to half

Inoculating fertile eggs with Newcastle Disease virus

their value each four and a half days, and that in a large number of birds from parents the majority of whom had been infected, about 60 per cent of the young birds could be effectively vaccinated at twenty-one days of age. This is known to be the most difficult set of circumstances in which to plan vaccination and now that the prevalence of the disease is much lower most birds can be effectively immunized at this age or somewhat earlier.

Time to immunize

During the early phase of the 1970 epidemic, the infection rate in broiler birds under four weeks of age was so high that it was necessary to try to provide some protection at as early an age as possible. For this reason, it was advised that all chicks be given a dose of vaccine in the first twenty-four hours of life. It was appreciated that this would effectively immunize only that small proportion which had much less than the average amount of maternal antibody; but as such birds were the most likely to be infected it was felt to be worthwhile. Initial recommendations for the second application of vaccine varied widely from ten to twenty-one days of age, the object always being to engender an active protection as early as possible. After analysis of trial results, we have found that even under rather adverse conditions the bulk of chicks respond best when immunized at twenty-one days

rather than at fourteen days. If the latter age is chosen the proportion of birds that fail to respond may in some instances be four times as high as when the vaccination is delayed to twenty-one days.

The recommendation has now been standardized on a first application at from eighteen to twenty-one days of age with a preceeding dose of vaccine at day old if the risk of infection in the young bird is extreme. Normally this dose will be of the B_1 strain, although in flocks that enjoy good respiratory health with freedom from mycoplasmosis and from the risk of infectious bronchitis it may be possible to use the LaSota strain with no measurable reaction. This will, however, be the exception rather than the rule.

Application methods

The normal route of application will be in the drinking water when 1,000 doses (1 vial) should be reconstituted in two and a half gallons of clean fresh drinking water (a guide to quantities is contained in copies of 'Fowl Pest Control: Vaccination. Advice to Flock Owners' available from the Ministry's Divisional Veterinary Offices). It is not important to dilute to exactly this level and the recommendations are a guide to the amount of water that the chicks are expected to drink in a couple of hours. It is important that the water used be fresh and clean, without any traces of detergent or disinfectant, and that it be placed in sufficient drinkers to ensure every chick can get free access to it. Research at Weybridge shows that almost all the mains water supplies in Britain are sufficiently pure to allow the water and vaccine alone to be used. Tests with the addition of 5 per cent skimmed milk have failed to give consistently better results although this technique is recommended whenever there is doubt as to the purity of the water.

The drinking water method is not as effective as individual eye drop application, but it causes the minimum of respiratory reactions. When a high immunity must be achieved at all costs, a higher and more consistent response can usually be obtained by using an aerosol machine available for this purpose. These vary in their requirements and guidance should be sought on the volumes required for each. As with drinking water application, it is important to use pure water and the most powerful antigenic stimulus will be achieved if the vaccine is reconstituted in distilled water rather than in tap water as this will ensure better survival of the virus. As about half a pint only is needed for each 5,000 doses, this can be obtained from a garage which supplies distilled water for topping up car batteries. It should be remembered, however, that when the virus is protected in this way, more of it will reach the bird and those particles that penetrate deeply into the respiratory tract may tend to set up a more severe reaction than is desirable. Whatever the disadvantages of the technique it is certainly the one which will render the largest number of birds immune to Newcastle disease in the shortest time. It is the method of choice in the face of emergency conditions.

Boosters

A general rule of immunology is that the response to vaccination is much more powerful after the second or 'booster' application of vaccine than after the first. This is particularly true of inactivated vaccines which are powerful when used as booster vaccines: it is unfortunately much less true of B_1 vaccine when given in the drinking water. To allow mass vaccination to be

carried out with the maximum benefit, the LaSota vaccine was introduced for the re-vaccination of birds that have had one effective dose (the application at day old should not be counted in this respect as it seldom immunizes a high proportion of the birds).

There is little to be gained by applying two doses of vaccine close together and the most effective re-vaccination follows an application with an interval of not less than three weeks after the first dose. In practice the second dose has been found to be most useful when given at thirty-five to forty-two days of age; provided both doses have been given with care so that each has had the chance to exert its maximum effect, then this should be all that a broiler will require. For production pullets, whether they be breeders or layers, it is usual to boost the immunity again at about ten weeks of age.

It is important to give the growing bird good immunity as it comes into production and the final dose of vaccine should be timed to be as close to point of lay as possible. For this dose, it is preferable to avoid the use of the B_1 strain as it is unlikely to exert as powerful a boost as is needed at this stage, and the best results come from the careful injection of one of the inactivated vaccines available for the purpose. Recent experience with the oil based vaccine has shown that it is capable of giving a long lasting immunity when given at this time: provided the manufacturer's instructions are fully adhered to it is likely to protect the laying bird safely through the first critical weeks of production well into the laying year. With other vaccines, boosting of the immunity is needed at intervals during the laying period (every three months in the case of B_1 vaccine and every five months in the case of LaSota vaccine). We do not yet have enough data to know whether re-vaccination with the oil vaccine is required during the laying season although other types of inactivated vaccine should be given again half way through the laying period.

Infectious bronchitis

One of the most serious diseases of poultry is infectious bronchitis. It would be wrong to concentrate all the effort into Newcastle disease immunization and to neglect IB with its attendant risks of coli septicaemia and, in the adult bird, of damage to the reproductive tract and the consequent failure to achieve a profitable level of egg production.

The general rules of immunization against infectious bronchitis are the same as those for ND although care must be taken to make sure vaccination against one does not interfere with the response to the other. Where IB is a risk to the growing bird, the first dose of vaccine should be given with the Newcastle disease vaccine at eighteen to twenty-one days in the drinking water. If it is known that protection against IB is needed at an earlier age, then the first dose of IB vaccine may be administered at nine to ten days of life so that there is a gap of at least eleven days before the first Newcastle disease vaccine is given. Care must be taken not to close the gap between the two doses or it will be found that no response to the ND vaccine has taken place because of the interfering effect the bronchitis virus has on the attempts of the ND virus to establish itself. As with Newcastle disease IB vaccination should be started off with the milder H 120 strain and re-vaccination carried out with the stronger H 52 where a high level of protection is needed, although there are on the market vaccines of a different level of activity that can be used in place of these two.

Vaccination failures

In dealing with a disease as difficult to control as Newcastle disease there are always a number of vaccination failures which seem to be inexplicable. It is the job of the veterinary specialist to investigate these. Most are undoubtedly due to failure to follow the rules of storage and application of vaccine and one careless step in the process can lead to a very costly failure. Vaccines badly stored or badly transported so that they are allowed to overheat may have a reduced level of efficacy; care should be taken to ensure that vaccine used has come from the manufacturer quickly and without risk of being allowed to become too hot. Large quantities should be held in a central store under the best conditions and moved to the farm immediately before use. Birds suffering from infectious bronchitis or from Gumboro disease will not respond well to vaccination, and the more incidental infections are present the less likely there is to be an effective response to Newcastle disease vaccine.

Research and prevention

To improve the level of control, research is being conducted into the production of more protective and less stressing vaccines, and also into the techniques of air filtration, disinfection and a means of early diagnosis so that adequate warning can be given of the need to vaccinate. On this last topic it will be obvious that the first step in diagnosis must always be the notification by the poultry farmer of suspected disease so that the Veterinary Officer is able to carry out his investigations. Neglect in this can easily result in a serious outbreak of disease before there is time to boost the vaccination of neighbouring flocks. In this area, too, the industry must help itself if we are to gain an effective level of control.

It is also essential that all the small flocks in the country are vaccinated as effectively as the large units. Another task of the poultry industry, therefore, is to make sure that all poultry keepers are aware of the need to protect their own flocks so as not to risk those of their neighbours.

Newcastle disease is likely to remain a problem for many years. The successful prevention of the disease will depend not only on the use of the most effective vaccines but also on improved standards of hygiene and the early notification of outbreaks of disease so that emergency vaccination may be carried out.

W. H. Allan, B.V.M.S., M.R.C.V.S., is a Senior Research Officer at the Central Veterinary Laboratory, Weybridge.

Green Crop Drying

The first International Green Crop Drying Congress will be held at the University of Oxford from 8th to 13th April 1973. Research workers, advisers, manufacturers and operators of drying plants from many parts of the world are being invited to present papers and reports.

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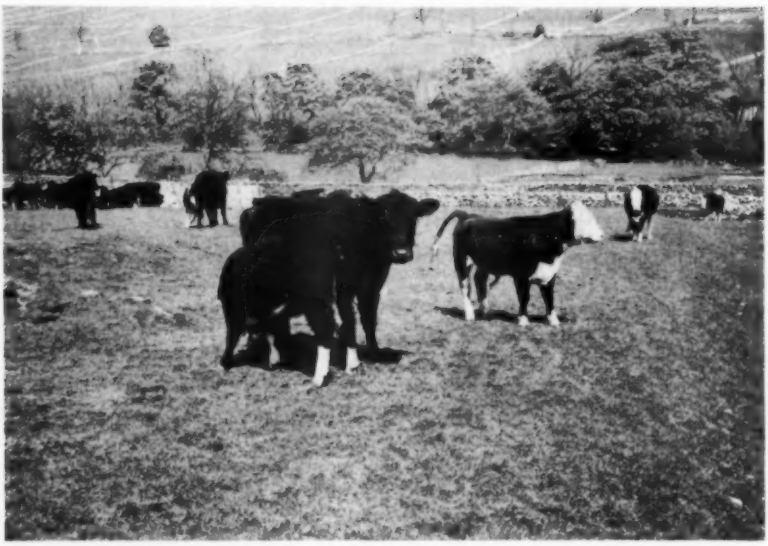


Cows and calves at grass

Aptly named—the rise of Phoenix Livestock Producers Ltd. for the

Co-operative Marketing of Suckled Calves

J. R. Mulholland **A. W. Stobbs**

FARMING in the Craven area of the West Riding of Yorkshire is traditionally based on milk production and the rearing of dairy replacements. Markets at Gisburn, Hellifield and Skipton have developed through the sale of second and third calved cows to dairy farmers in Lancashire, Cheshire and other parts of the county. It was not until the 1960s that suckler cows began to assume the role of a major enterprise on some upland farms and in consequence there were no special facilities in the area for the sale of suckled calves. They were sold at the ordinary store cattle sales.

Beginnings of co-operation

In 1963, suckled calf producers in the area and adjacent parts of Lancashire formed themselves into the North Pennine Suckled Calf Breeders Association. They organized two special sales, one at Skipton, which attracted 657 calves, and one at Lancaster, for 513 calves. But the animals presented were of such a mixed assortment that it was obvious that any progress would depend on a much greater degree of uniformity in the breeding, age, and weight of calves offered for sale. Although there was an increase in the number of members and in the number of calves at later sales, there was very little improvement in calf quality. Consequently the Association was wound up in 1968.

There were, however, four members who believed in collective marketing but who were dissatisfied with the auction system and the price variations that occured during the course of a one day sale. They were also anxious to improve calf quality and were prepared to accept discipline in order to achieve that aim. So it was that out of the ashes of the North Pennine Association arose Phoenix Livestock Producers. With help from the Central Council for Agricultural and Horticultural Co-operation, this new co-operative commissioned Newcastle University to carry out a feasability study on alternative methods of disposing of the annual crop of suckled calves produced by members. The investigation included both the co-operative marketing of weaned calves and the establishment of a co-operative feed-lot.

The feasability report was presented early in 1969 and recommended against the establishment of a fattening unit. It was, however, in favour of the direct selling of weighed and graded calves, preferably to a feeder or, if that was not possible, to a marketing agency. The latter course was adopted in 1969 and all calves were sold through Farmway, an agricultural co-operative company based at Darlington.

Meanwhile, the four original members had increased to seven and it was agreed to the registration of Phoenix as a limited company under the Companies Acts 1948 to 1967. The arrangement was that members would offer all eligible calves to Phoenix, and Phoenix would accept the responsibility of finding the best possible market outlet.

Code of practice

At the time of the formation of the company, members were producing calves from thirteen different breeds and crosses of suckler cow and four breeds of bull. At sale time these calves varied in weight from 221 lb to 1,048 lb. Obviously, drastic measures were required if any degree of uniformity was to be achieved. It thus became company policy to produce and market top quality black Hereford cross calves or Charolais cross calves weighing 600 lb at the date of sale. In order to achieve this objective, a Code of Practice was drawn up and accepted by all members. This included the following:

1. Only Hereford or Charolais sires to be used.
2. All calves to be creep-fed and dehorned.
3. Records to be kept of birth weight and two subsequent weighings.
4. Calves to be sold on the final weight, the Company not being responsible for selling calves weighing less than 400 lb.

5. Members to aim at a uniform herd consisting of only one of the following types of suckler cow:
   (*a*) Galloway × Friesian
   (*b*) Angus × Friesian
   (*c*) Hereford × Friesian
   (*d*) Blue-Grey (to be used only with a Charolais bull).
6. Calving should be limited to two periods in the year
   (*a*) Autumn calving between 1st October and 15th December
   (*b*) Spring calving between 1st April and 15th May.
7. Heifers should calve one month earlier so that the smaller calves would equal in size and weight those from older cows at sale time.
8. All calves to be dosed against worms in early July.

It is a measure of the determination of the members to produce top-quality calves, and of their faith and confidence in each other, that this Code of Practice has been faithfully adhered to. Furthermore, it has not been found necessary to change any of the items originally agreed.

A group of 'Phoenix' calves at weaning

Early results

In 1969, the first full year of Company operation, 274 calves were reared by Phoenix members, but because of the acceptance of Company discipline only 195 were eligible for sale. They produced an average net return of

£53·6 per calf compared with an average price of £38·8 for calves sold at the annual suckled calf sale at Skipton.

The eighty calves that failed to meet Company standards were mostly from late calving cows and had not attained the 400 lb minimum weight. A similar number of small calves was expected in 1970, so the Company undertook to purchase them from members in late November (a month after normal sale time) and to arrange for them to be wintered on a lowland farm. The aim would be to add about 150 lb liveweight to these 400 lb calves so that a spring buyer would obtain a reasonable return from finishing on grass.

In the event, only thirty-three calves produced by members failed to reach the required weight in 1970. These were wintered, together with twenty-eight similar calves purchased at Skipton Suckled Calf Sale, on a farm in the Vale of York. The performance during this period was modest, a liveweight gain of only 0·67 lb per day; by the time all costs had been met the margin was a mere £5·36 per calf. This operation has not been repeated.

With the passage of time, it has become apparent that one of the real benefits resulting from membership of a group such as this has been the improvement in the physical performance of the cattle. This has been stimulated by the keeping of detailed records and by the subsequent discussions that have taken place between members and advisers. Group visits to members farms have helped considerably in this respect.

Aiming at uniformity
Replacement in-calf heifers

Correct breeding stock

Having stated their aim as being to market top quality black Hereford cross or Charolais cross calves, the Company's first priority has been to encourage the acquisition and use of the correct type of breeding stock. This

was relatively straightforward and rapid so far as bulls were concerned. Since 1968, all the bulls purchased have been selected on the basis of conformation and performance figures and have been bought either at recognized sales or privately on the recommendation of the Ministry's A.D.A.S. advisers. In 1969, all the bulls being used were Herefords; at the present time there are ten Hereford bulls and five Charolais.

The establishment of a more uniform type of cow is a more difficult problem and is taking longer to achieve. In 1968, week-old Angus and Galloway cross Friesian heifer calves were purchased from dairy herds and a common replacement policy was brought into being. Calves have been purchased each year since then and each member has reared his own heifer replacements with the aim of calving them in the autumn at 24–28 months of age. The number of calves purchased had risen to approximately seventy by 1971; at this rate, by 1975 the whole group should have uniform breeding cows with a milk potential to produce fast growing calves.

Records collected to date indicate that the original choice of cow was sound, in that the Angus or Galloway cross Friesian is particularly suited to the conditions of the area. The aggregate performance of all breeds of cow on members' farms is shown in the following table:

Table 1

Performance of cows by breed on the basis of a corrected 200-day calf weight. All calves by a Hereford Bull

Breed of Cow	Records	Years	Farms	Corrected Wt (lb)	Range (lb)
Angus × Friesian	72	3	6	462	279—588
Galloway × Friesian	23	3	5	450	337—550
Shorthorn × Highland	20	3	1	424	354—494
Irish (Black)	13	3	2	409	353—554
Blue-Grey	72	3	6	406	283—530
Hereford × Friesian	78	3	4	402	249—553

Records on cows calving to the Charolais bull are as yet few in number but they suggest that there will be no major changes in the relative order of merit.

Calving

The farms within the Company are more favourably suited to autumn rather than spring calving and eventually it is expected that the majority of cows will calve before 15th December. A small number of spring calving cows will remain on those farms where layout and topography requires a split herd. The move from spring to autumn calving has been slow, but with large numbers of autumn calving heifers coming in to the group it is now beginning to accelerate. It has been possible to gain time with some of the cows calving in January and February while some late calving cows have been allowed to lose time in order to bring them into the autumn period. Table 2 shows the move towards autumn calving, although the position has been confused by the inclusion of new members with large numbers of spring calving cows.

Table 2 **Calving pattern**

	1968—69	*1969—70*	*1970—71*
Autumn Calvers (Aug—Dec)	84	91	131
Spring Calvers (Jan—July)	158	195	191
Total	242	286	322

The combination of an increase in the proportion of autumn calving cows together with an improved physical performance has led to a marked improvement in the weight of calves offered for sale. Consequently the recommended target of producing uniform calves weighing 600 lb liveweight is now well within reach. Progress in this direction is summarized in Table 3. The problem of the small calf weighing less than 400 lb had, in fact, virtually disappeared by 1971.

Table 3 **Mean weight of calves at sale (lb)**

	1969	*1970*	*1971*
Mean	496	519	577
Herd range	383—598	420—615	450—696

Future developments

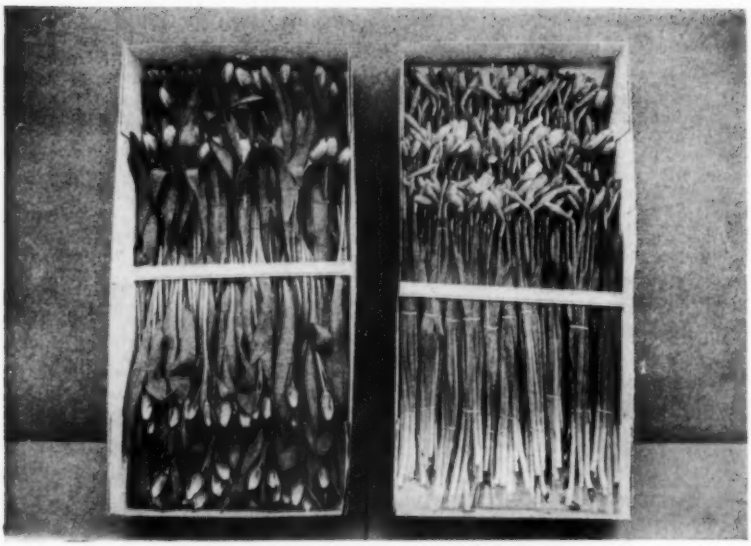
Phoenix Livestock Producers Ltd. is now approaching the end of its fourth year and the question arises of future developments. The original target is now within sight; indeed the founder members have already achieved it. The next aim must be to get all members up to the standard of the best and in this respect it is much easier to have a few members each with a large number of cows than to have a large number of members each with a small herd. Nevertheless, new members will be welcomed to the Company provided that they are willing to accept the discipline.

Further developments by the Company could centre around the rearing of accredited replacement heifers on a contract basis. This has already been investigated but the problem of financing the operation has yet to be resolved.

The uncertainties associated with entering the E.E.C. raise the question of the optimum calving date. If there is to be an increased demand by feeders for suckled calves to finish off grass, then there could be an increase in the number of spring calving cows. This would mean that calves would continue to suckle until Christmas, or later, and then be fed well on members' farms prior to a February or March sale. If, on the other hand, the demand for extra beef means that there will have to be an increase in the weight of finished animals then grass feeders will still need autumn born calves.

The most outstanding feature of Phoenix Livestock Producers Ltd. has been the way in which eight comparative strangers have grown together as a Company through the discipline that they have imposed on each other. Out of that discipline has grown the confidence with which they can now face the future together.

J. R. Mulholland, B.Sc., D.T.A., is a Livestock Husbandry Advisory Officer and **A. W. Stobbs, B.Sc., M.S.,** is a Senior District Agricultural Advisory Officer, both serving with A.D.A.S. at Skipton, Yorks.



Commercial boxes of tulip and narcissus flowers

EXPERIMENTAL HORTICULTURE STATIONS

Bulb Flower Forcing

J. B. Briggs

It is estimated that in Britain approximately 70 per cent of the annual production of saleable narcissi and tulip bulbs are used for out-of-season flower production under glass in the period November to April and for early flowers in the open in the south-west of England. In the five year period 1968–72 some 300 million flower bulbs were forced under glass during each winter season, most of these in the Holland division in Lincolnshire, on holdings where the bulbs were grown. In that period the acreage of glass used for forced bulbs in Britain has remained fairly constant at between 165 and 175 acres, of which the Holland division, Lincolnshire, accounts for 100 to 105 acres.

The temperature treatments to which narcissi and tulips have to be subjected to promote out-of-season flowering were investigated fundamentally in the Netherlands in the 1920s and 1930s. Before 1962, when work on bulb forcing started at Kirton E.H.S., British growers had to rely almost entirely on recommendations based on work in the Netherlands where soil and climatic conditions are different from our own. The first priority when work started at Kirton Experimental Horticulture Station, therefore, was to examine the

Dutch recommendations under our conditions. With the facilities available, the controlled temperature storage treatments needed to promote early flowering of narcissi and tulips from November to January have received the most attention in the last ten years.

With the completion of the series of experiments, work on early forcing has continued over a wider field with the aim of achieving earlier and quicker flowering, higher flower yields and improved flower quality. Work is also in progress on new techniques, such as '5°C' or 'direct' forcing of tulips, which require evaluation under British conditions, and on the use of growth-regulating chemicals to control narcissus and tulip stem length and so make them suitable for pot plant production.

This article describes the main treatments needed to prepare bulbs for early forcing*.

Geographical distribution

Many features of narcissus and tulip behaviour can still be related to their original habitat and this helps to explain the temperature treatments needed to promote out-of-season flowering.

The main centre of natural distribution for tulips is in Asia Minor where the combination of high summer temperatures and low rainfall, followed by low winter temperatures, means that tulips in the wild have to survive two consecutive adverse periods. The effect of summer is avoided by summer dormancy and this explains why tulips die down so early in the summer; the effect of winter is avoided by a low temperature requirement which ensures that bulb growth starts only at the end of winter.

For narcissi, which have less well defined origins, the same general principles apply. However, as the narcissus is a plant from more temperate regions, the summer dormancy is less obvious, although the low temperature requirement is still present and similar to that of tulips.

It is during the period after lifting following the start of summer dormancy at the end of June to the beginning of July that the bulbs respond to storage treatments in preparation for forcing.

Flower development inside the bulb

Recognition of flower development within the bulb is important to determine the timing of temperature treatments which are necessary to prepare bulbs to flower before and immediately after Christmas. In narcissi, flower formation starts in mid to late May and in most cultivars is normally completed (Stage Pc or paracorolla) in the eastern counties of England by the end of July to the beginning of August. Flower formation in tulips starts in early July and is completed (Stage G or gynoecium) by mid-August in most seasons†.

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*A comprehensive guide to narcissus and tulip forcing is contained in the Kirton Experimental Horticulture Station Leaflet No. 1, obtainable on request from the Station, Boston, Lincs.

†Full details and illustrations of the internal development of narcissus and tulip flowers are given in the M.A.F.F. Technical Bulletin 22—Internal Stages of Bulb Development; price 17½p (by post 20p), obtainable from H.M.S.O. or through any bookseller quoting SBN 11 240922 9.

High temperature storage

The combination of high temperature storage at lifting together with low temperature treatment is needed to obtain the earliest narcissus and tulip flowers. High temperature treatment alone will not advance flowering.

Although developed from species found in the temperate regions of the world, narcissus cultivars Carlton, Fortune and Golden Harvest, forced widely in the eastern counties of England, show considerable response to high temperatures at lifting. Bulbs required for flowering before Christmas should be lifted early, at the end of June to the beginning of July and stored at 35°C as soon as possible afterwards for a period of five days. This treatment gives the best results in terms of earliness of flowering combined with good flower quality, bringing flowering forward by ten to fourteen days compared with bulbs stored at 17°C from lifting.

In their natural habitat tulip bulbs are subjected to a period of very high soil temperatures in summer. In Lincolnshire, whilst the soil temperature is sufficiently high to allow development of a flower, earlier forcing can be obtained by supplementing the temperature after lifting. Experimental work has shown that high temperature applied to the bulb at the end of June to the beginning of July, when the skin is immature (yellow brown) and it is still in the vegetative stage of growth (Stage I) internally, advances completion of flower formation (Stage G) as well as flowering. The response is not so great if the treatment is applied at Stage II when flower formation has started (mid-July).

Bulbs required for flowering before and immediately after Christmas should be stored at 34°C for seven days at the end of June, as this treatment gives the maximum response, bulbs flowering seven to ten days earlier than those stored at 20°C.

Intermediate temperature storage

After high temperature storage (or after lifting for bulbs not given this treatment) most rapid completion of flower formation in narcissus and tulip results from storage at 17°C and 20°C respectively. In commercial practice this means that narcissi are generally stored in an unheated building and tulips in a controlled temperature store. Continuous storage at temperatures above 20°C is likely to result in delayed flower formation.

Low temperature storage

As low temperatures are needed for leaf and flower stem elongation, bulbs that are required for housing up to the beginning of January have to be cool-stored to simulate the conditions they would normally experience in the field during the winter. The low temperature treatment must be used in conjunction with high temperature storage to obtain the earliest flowers, whereas low temperature storage can be used on its own when flowers are required between late December and mid-January. The longer the period at low temperature, the quicker the bulbs will flower and the longer the flower stems; length of time to flowering and stem length are a measure of how far the low temperature requirement has been satisfied.

Cultivars differ in their low temperature requirement and therefore those that need a short time will force earlier than those that require a lot of cold. The cold requirement of individual cultivars varies little from year to year.

Thus the forcer is able to organize his forcing programme to suit a range of cultivars.

When bulbs are required for early forcing it is important that low temperature storage starts as soon as the flower formation is complete—Stage Pc (narcissus) and Stage G (tulip). In narcissi, treatment started before Stage Pc can cause splitting of the trumpet or corolla, although it is unlikely to cause flower blindness. In tulips, storage started before Stage G may deform the flowers and as there is usually some variation within a stock of bulbs a safety margin of one week should be allowed for all bulbs to reach Stage G.

Narcissus

The recommended treatment is 9°C for six weeks when the bulbs should be boxed. Longer periods of treatment mean later boxing, which counteracts the benefit obtained from the extra period in store, and flowers will be smaller. Narcissi are usually stood in the open on a standing ground after boxing when every effort should be made to keep them as cool as possible, preferably not above 13°C by covering with 12 in. of straw. Irrigation is also necessary, not only to lower temperatures but also to keep the soil moist to encourage rapid root growth.

Experimental work has shown the importance of early cool storage, starting at Stage Pc, combined with boxing in mid-September when preparing bulbs for early forcing, to allow sufficient time for root and shoot development to take place before housing in November. Bulbs cool stored at 9°C are ready to house two to three weeks earlier than those not treated, because of earlier and quicker elongation of the flower stem out of the bulb.

Tulip

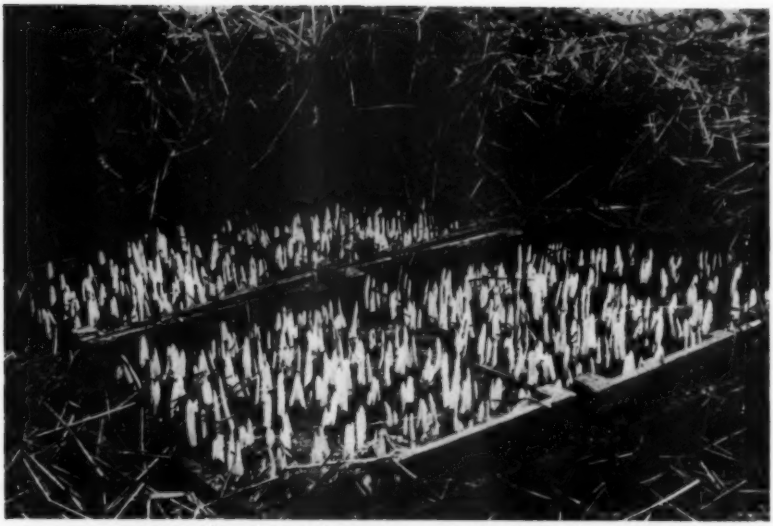
Experiments have shown that 9°C for six weeks is the safest treatment for earliness of flowering, quality and a low percentage of shrivelled flowers. However some cultivars show a useful response to lower temperatures resulting in either earlier flowers or longer stems. Apeldoorn, which requires a long period at low temperature to flower satisfactorily, has shown a considerable response to storage at 4·4°C for eight or twelve weeks; this has resulted in much earlier flowers without a serious reduction in flower quality, compared with bulbs stored at 9°C.

At the end of the six week storage period (beginning of October) the bulbs are boxed and either stood on the standing ground or returned to 9°C until ready to house.

This latter treatment, known as wet or double cooling, is preferred where bulbs are to be housed up to the end of December, as apart from 5°C or direct forcing it is the only method to ensure successful early forcing. As bulbs are kept under controlled conditions, the amount of low temperature needed by a cultivar for satisfactory forcing measured as a total number of weeks at 9°C (dry and wet cool storage periods) can easily be calculated. At the end of this period the bulbs are ready to house, irrespective of the position of the flower bud in the bulb.

The minimum number of weeks at 9°C needed to give satisfactory results in terms of length of time to flowering, stem length and percentage marketable in a range of cultivars is as follows:

Trance 14	Rose Copland 17	Merry Widow 18
Paul Richter 15		Apeldoorn 19



Boxes of narcissi on the standing-ground just before housing

Readiness to house

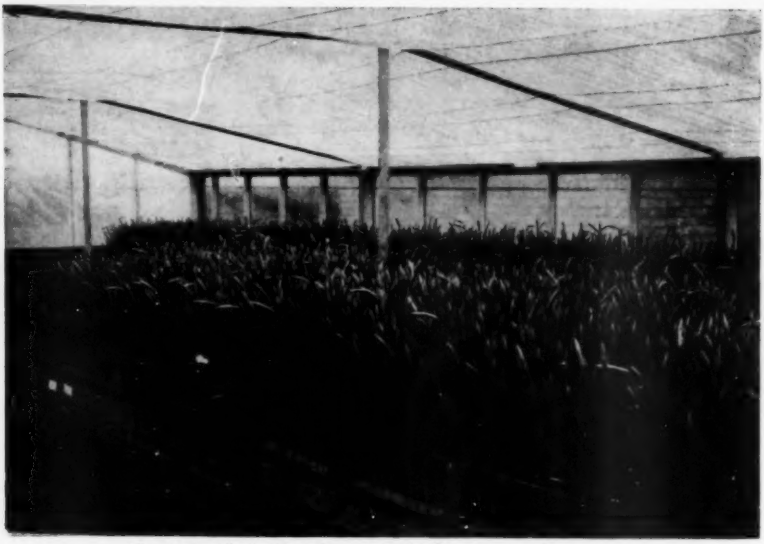
At the present time it is not known how a bulb integrates the varying temperatures it experiences on the standing ground and it is not possible therefore to determine accurately when sufficient cold has been accummulated to ensure quick flowering (four weeks in the glasshouse for early forcing) and long flower stems. Consequently, growers can judge only when the bulbs are ready to house from the position of the flower bud in the neck of the bulb—if it is in the neck, most cultivars are considered ready to house.

Narcissi given high and low temperature treatments are usually ready to house in the middle of November and the first flowers will be cropped at the end of November to the beginning of December, the majority of the early forcing being for the Christmas market. Early forcing cultivars of tulip such as Paul Richter and Trance will flower from the middle of December given high and low temperature treatments provided they are returned to 9°C after boxing. The bulk of the early flowers, however, are marketed in the New Year.

Glasshouse temperatures

Narcissi are usually forced at 13–16°C and tulips 16–18°C. However, where bulbs are housed in November and December the temperature can be raised gradually from 13°C, a procedure which will give better flower quality and help to achieve reasonable stem length, particularly where there is some doubt whether the bulbs will force readily due to too early housing. With

tulips housed in November and December it is not advisable to hasten flowering by forcing above 18°C as this could result in a high proportion of blind and damaged flowers.



Narcissi with the first flowers at the fat goose-neck stage

Marketing

Narcissi are usually cropped at the fat goose-neck stage when the petals are just about to open. With forced narcissi, some foliage is also included in the bunches which are usually of ten blooms. Tulips are cropped when all petals are showing colour at the edges but not fully coloured and are marketed in bunches of five blooms.

Regulation of the flow of flowers to market is sometimes necessary and can be achieved by storage of the blooms at low temperatures. For both narcissi and tulips storage at 2°C is recommended and provided storage does not exceed four days there is little or no adverse effect on subsequent keeping quality or vase life. At Kirton, both narcissi and tulips are stored dry in chitting trays covered with polythene to reduce water loss and prevent desiccation.

As flower spot, mainly caused by tulip fire (*Botrytis tulipae*), can be troublesome in stored tulips, it is important that only healthy flowers are stored; those with diseased or damaged flowers and leaves should be rejected.

Most forced flowers are marketed through traditional channels. However, as narcissi and tulips lend themselves to pre-packing it is anticipated that this trade will increase as the development of self-service selling of flowers gains momentum.

J. B. Briggs, N.D.H., is a Horticultural Advisory Officer at Kirton Experimental Horticulture Station, Boston, Lincs.

The Farm Trail

Noel A. Aldiss, *Lands Arm, A.D.A.S., Oxford*

THERE are several good reasons why farmers and others who control land might consider the formation of a Farm Trail in their areas as a follow up of Nature Trails which have proved so popular. The development of country parks in particular provides splendid opportunities for exploiting trails to the full.

Firstly, trails have an educational value in promoting the message of farming, the backbone of the countryside, and can go some way towards teaching its proper use for quiet recreation and enjoyment. Thus the Trail can help to reduce the abuses suffered by those who farm on the urban fringe near some 'Honey Pot' attraction. A trail can also give the visiting public a greater interest in farming and this could reduce some of the uninformed criticism so often levelled at British agriculture about modern farming methods. A well planned trail can lead the public away from areas where for good farming, sporting or estate management reasons they are not really welcome and guide them to places where the effect will be minimal.

Planning the trail

The length of the trail will depend mainly on the existing network of public rights of way and also on the type of terrain to be traversed. It should not be too long nor take up too much time. About two miles is a reasonable target, for it is a distance which will allow time to stop and to savour the beauty of the scene while leaving the comfort of the family car only for little over an hour. In hilly country two miles may be too long for people not used to walking, and in such areas a shorter route might be considered.

Public footpaths seldom run so as to provide a circuit and it may be necessary to open linking stretches of permitted paths to complete a suitable route. Care must be taken to ensure that there is no risk of these permitted paths becoming public right of way.

In planning the trail, an area of small fields with a wide variety of crops and livestock is ideal. A walk round a single vast field of one crop will not hold the interest of the visitor for long.

Those participating in the trail will need to be provided with a simple map with the route to be taken clearly marked and supported by notes giving the approximate distance and the time required to complete the circuit. The trail itself will also need to be clearly marked and points of interest number-referenced on the map and on the ground.

Do's and dont's on the trail

Visitors may also need to be warned about special difficulties such as boggy ground, steep hills or stiles. If the trail is unsuitable for light footwear this should be stated.

Mention might also be made of precautions visitors are asked to observe. Try to avoid orders such as 'Shut the gate', 'No smoking', 'No dogs'. People will respond better if these matters are brought in to the text with an explanation; for example, the fire risk of smoking in woodlands at certain times of the year. It is probably better to provide good sound stiles and keep gates locked than to risk stock being allowed to escape because of thoughtlessness. Reference should also be made to the Country Code, copies of which could be provided with the trail notes.

Notes on matters of interest

Some brief notes will also be helpful describing the type of country to be traversed, the farming of the land through which the trail is laid and calling attention to special features to be observed including viewpoints.

The notes could contain a brief description of the soil type and its quality. Each field should be named and its area given. This can be followed by a description of the crop, its potential yield, when it will be harvested and the use that will be made of the resulting product. Describe the cultivations necessary and if the crop has to be sprayed with herbicide or insecticide say so and give reasons for the operation.

If the trail passes through pastures, a brief mention of the difference between permanent grass and temporary leys will be helpful. Of interest will be the needs and uses of the animals grazing and the reasons for such matters as dehorning, sheep dipping and docking of tails. In fact, any feature likely to awaken interest.

Preferably the route of the trail should avoid buildings. If this is not possible a brief description of the principal building and what goes on inside could be given, including simple statistics such as the area required to winter-house a cow or store a ton of hay, silage or corn, or for milking techniques etc. Equipment such as milk churn stands, mineral licks, electric fences, troughs and so on may all be worthy of comment.

Explain that agricultural workers are not 'labourers' but skilled men who may have in their care thousands of pounds worth of animals, crops and machines. Stress that the industry is not subject to industrial strife and progressive farmers know they must provide good houses for the men if first class workers are to be kept in the industry.

Every farm has its wild life and although farming must have first priority in the notes there should be some references to nature. Rabbits, pigeons and grey squirrels are pests to farmers, but some townsmen regard them with affection. Explain the damage they do to farm crops, and to woodlands, pointing out examples of such damage whenever possible.

The notes being intended as a handout to visitors, should necessarily be kept simple and free from jargon. The need to provide background information in this form might possibly discourage some who might otherwise be willing to organize a trail. Discussion with A.D.A.S. at the nearest Divisional Office of the Ministry in the first instance could lead to an offer of help with the

preliminary arrangements. The local branch of the Naturalists Trust would also likely to be helpful with the preparation of notes on wild life.

Finally, don't be afraid to invite people to comment on the trail, and do offer to explain in detail any farming matters they find especially interesting. In this way most advantage can be taken of an opportunity to tell the townsmen about the countryside.

Gun Lore

Every year a number of people are killed or seriously injured on farms as a result of shooting accidents, most of which are caused by the careless or inexperienced handling of guns or through defects in the guns themselves. Many of these accidents occur when farmers or farm workers take their guns with them while they are out working on the land. But it is not only adults who suffer as a result; children, too, are often the victims of careless gun handling.

Many deaths have occurred because loaded shotguns have been carried on tractors or other farm machines. This practice is not only foolhardy—it is extremely dangerous. If you must carry a gun on a vehicle it is vital to make sure that it is unloaded.

If you have to climb over or through obstacles while carrying a gun, always remove the cartridges first. It is no good relying solely on the effectiveness of the safety catch. Nor is it safe, with some old hammer guns to let the hammers down. A gun with a faulty firing mechanism may go off if it is dropped, and a hammer can catch on twigs, branches, nails or similar projections and be pulled back sufficiently for it to strike and fire the cartridge. Some hammerless guns have been known to go off even when the safety catch was on because of a fault in the internal mechanism that the user knew nothing about.

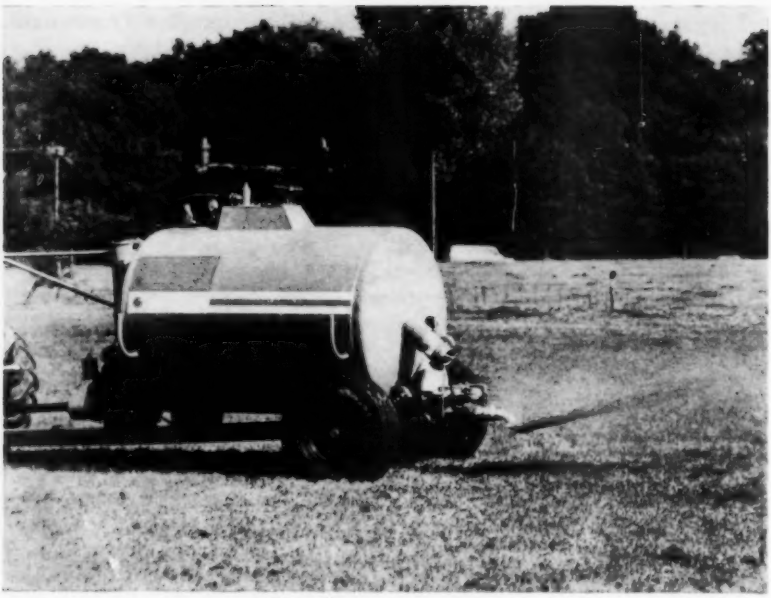
Before aiming a gun, make absolutely certain that you can see clearly where you are intending to shoot and that no one is in the line of fire.

Always treat a gun as if it is loaded. Keep it well maintained and in a safe condition. If you are in any doubt at all about this, have it overhauled by a competent gunsmith and proof tested.

It should be remembered that a ·410 shotgun is just as lethal as a 12-bore; it is not a learner's weapon just because it is smaller and lighter.

Children are naturally inquisitive and seem to have an inherent interest in guns. Never stand a loaded gun in a corner of any room to which children have access. Make a habit of putting guns and cartridges in a safe place immediately after use, preferably under lock and key.

If these commonsense rules are followed, you will not only continue to enjoy your sport but you will also help to *Keep Farming Safe.*



A 700 gallon tanker in operation.
This type of tanker lends itself to group use.

Group Operations: Waste Disposal by Tanker

Warner K. Hall

USING a tanker is only one of the methods on the farm available for disposal of liquid waste. However, liquid manure tankers are seldom operated to capacity on any one farm and there are situations on many farms where it may be advantageous to share a tanker and its associated labour in order to reduce the amount of capital invested in machinery. On small farms where labour may not be available for this task it is possible to use a group to operate a tanker and thus take advantage of improved waste handling.

The larger capacity tankers are able to do more work for a given tractor and labour input and can handle wastes of varying dry matter. The working rate of all tankers depends on the tanker capacity, filling rate and the transport distance. It is important to choose the right kind of tanker for the particular project in hand after consideration of factors of distance and the

dry matter content of the waste. (More details on tankers are given in M.A.F.F. Mechanization Leaflet 26*).

Example

To illustrate the sharing of a tanker for waste disposal, the following is an example of its use between three farms.

Farm A consists of 250 acres of mixed cropping with fifty cows housed on straw. It has a covered collecting and feeding area, and the liquid waste is scraped in to a storage tank below ground. The problems on this farm are that at times the dairy cows refuse to graze after waste has been spread on the grassland and the old 500-gallon tanker used has an ineffective spreading mechanism.

Farm B has 300 acres of arable cropping and a 500-pig fattening unit. Waste disposal is by a slatted dunging passage leading via sluices to a storage tank at the piggery end. The problem here is disposing of waste at times of the year when crops are growing. Disposal is limited to periods after crop harvest and to a very few other times in the year. The small 350-gallon tanker used is labour consuming and ineffective.

Farm C, of 100 acres, is mainly down to grass. It has forty dairy cows housed on straw, with the collecting and feeding areas only partly covered. There is also a 100-pig fattening unit housed on straw which produces a small amount of liquid waste. The problem is that the farm buildings adjoin a stream, as does most of the land and there is, therefore, a danger of pollution. The present 250-gallon tanker is used for waste disposal on land away from the farm.

The tankers on Farms A and B are outdated and ineffective; that on Farm C had proved to be totally inadequate and the use of a contractor had been considered. After discussion amongst the group on the quantities and consistency of the waste to be handled, it is decided that a 700-gallon tanker filled by vacuum and emptied under pressure should be purchased. This has the ability to travel on land when conditions are suitable and to discharge its load through pipelines and a manure gun when they are not. The cost with pipelines and manure gun would be approximately £900. Farmers A and B have tractors and men available and there is a large tractor on Farm B ideally suited to operating this type of tanker. Figure 1 overleaf illustrates the systems of waste disposal on each farm before and after the setting up of the group.

Under the group arrangements Farmer B would become responsible for the maintenance of the tanker and for this reason it is based on his farm; the tractor driver from that farm would operate the tanker on his own farm. When Farmer A wishes to use the tanker he would collect it from Farm B, use it on his own farm with his own tractor and labour and then return it to Farm B. When collecting the tanker from Farm B, Farmer A would collect a load of pig waste to add to his own storage tank. This would be mixed with the cow waste and so overcome to some extent the problem of grazing refusal.

*Mechanization Leaflet 26. *Tanker Equipment for Liquid Manure Disposal* may be obtained from The Government Bookshop, P.O. Box 569, London SE1 9NH, price 6p (by post 8½p) or through any bookseller quoting SBN 11 240683 1.

When Farmer C requires the tanker it would be operated by the tractor driver from Farm B. When Farmer B is short of land for disposal of his pig waste he can dispose of it on Farms A and C.

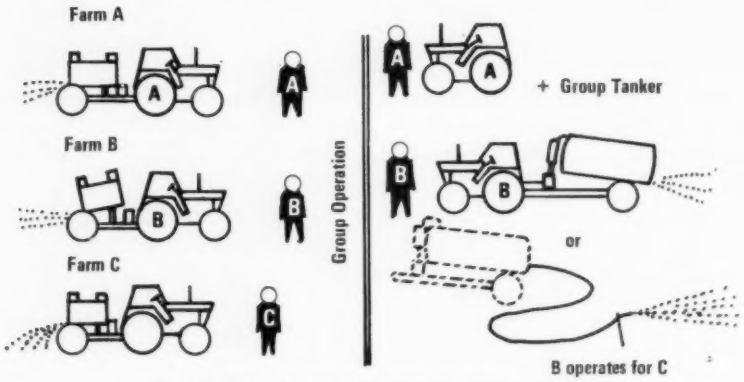


Fig. 1. Waste disposal requirements of Farms A and B for manpower and machines before and after group operations

Costs

In order to determine how to divide the annual costs of operating the tanker the group decides that the best method would be to apportion the costs on the basis of the annual gallonages handled on each farm. The figures for each farm are almost equal, being in the order of 350,000 gallons per year. It is decided, therefore, that the initial cost and annual cost should be split equally. When Farmer B provides a tractor and a man for Farm C, there would be charges of 40p per hour for the tractor, 15p per hour for fuel and 50p per hour for labour. This is the agreement made by this particular group for their special situation. In other situations, it would be important that arrangements are made to adjust labour and machinery charges and a simple record sheet can be devised to enable balancing out of these costs at the end of the season.

If, however, the three farms had decided to operate independently, then Farmer A would have had to acquire a similar type of tanker to that operated by the group and Farmer B could have used a smaller 450-gallon tanker. Neither farmer, however, would have had the advantages of disposal on the other's land. Farmer C would have had to employ a contractor to dispose of his waste away from the farm and this would have cost in the region of £2·50 per thousand gallons. The Table opposite shows the likely costs operating independently and as a group and shows the savings achieved by group operation of this tanker.

Farm	A 250 acres		B 300 acres		C 100 acres	
	Individual	Group	Individual	Group	Individual	Group
	£	£	£	£	£	£
Machine costs	324	107	295	107	—	107
Tractor fuel and labour at £1·05 per hour	—	—	—	—	—	240
Contract disposal at £2·50 per 1,000 gal.	—	—	—	—	869	—
Total annual cost	324	107	295	107	869	347
Saving by group operation	217		188		522	

This group follows the basic guidelines and rules as discussed in the first article on group operation.* So far the operation has run smoothly and successfully to the benefit of all group members.

Where it is important to prevent the spread of disease between farms it is essential to consult a veterinary surgeon as to the risks and precautions to be taken when group operation for waste disposal is considered.

Warner K. Hall, N.D.A., N.D.A.E., is a Mechanization Adviser with A.D.A.S., at Wye Sub-Centre, Ashford, Kent.

*Published in the August issue

Warble Fly

Now is the time to treat cattle for warbles. Cattle attacked by warble flies produce less meat and milk and are subject to gadding which can result in serious injuries. All farmers are urged as a matter of good husbandry to dress any cattle this autumn which have been outdoors during the summer. Farmers will thus reduce the risk of infestation in their herds, and those of their neighbours, next year.

A single application during September, October or November of one of the systemic insecticides is best for this purpose. They are quick and easy to apply, but must be used strictly in accordance with the manufacturers' instructions. The cost is amply repaid by the improved condition of the animals. Treatment should *not* be carried out from iate November until the end of February, but the same systemic preparations applied during March will kill the grubs before they emerge. Cattle showing visible or palpable evidence of infestation in the spring or early summer can also be dressed with 'derris dressing'.

Care should be taken to store these chemicals safely away from children and animals. Empty or used containers, if not returnable, should be properly disposed of so as to prevent possible contact with children and animals and to avoid possible contamination of watercourses.

Modern Goose Production

John Halliwell

MANY farmers must have looked at the high prices that geese have realized at Christmas during the past few years and asked themselves 'Is there anything in it for me?'.

Nationally, geese numbers seem to have been declining steadily for years, and the high prices are simply the result of the demand exceeding the supply. It is unlikely, however, that traditional goose keeping will ever again become sufficiently popular to make up for the deficiency in supply. Keeping a gander and a couple of geese and hatching and rearing one's own goslings is such a risky business that it can appeal only to a few. Even with a profit of between £1 and £2 per goose, it is still only a spare time 'pin money' job.

However, more farmers are becoming interested in larger scale goose production and this is now possible, as day-old goslings are available in fair numbers for much of the year; they usually cost 50–60p each.

Advantages—and some disadvantages

The goose is a fast-growing bird, with an obvious cost advantage over chickens, turkeys and ducks, in that it can convert grass and other green-stuffs into flesh. Its chief disadvantage is its temperament. Geese are easily frightened or upset, and will often pine and lose weight for the simplest of reasons.

Brooding geese is easy—they need heat only for about the first fortnight—but they should not be allowed to range on pasture until they are at least four weeks of age. The most obvious method of keeping them after this initial brooding stage would seem to be the natural one; namely, outside on good short grass. The most rudimentary shelter will suffice; small sheds with adequate ventilation in which the geese can be shut in at night.

One snag when talking about keeping geese by the thousand, or even by the hundred is that the amount of pasture required and the fencing of it assumes large proportions. It is impossible to be precise about the stocking rates of geese on pasture. A maximum of twenty-five birds per acre is quoted in some handbooks, but this applies only when there is no supplementary feeding. On light land, with good short grass, and where supplementary feeds of grain or pellets are given, the figure can be at least doubled or trebled. The ideal is to be able to paddock graze the geese, or to have alternative pens to which they can be moved every fortnight or so; with paddock grazing under good conditions, up to 100 or even 150 geese per acre are possible.

The type of fencing needed will depend on the risk from foxes. Where the pasture is isolated and there is a big risk from these marauding predators in the daytime, a 6-foot high wire netting perimeter fence with a single strand

of electric wire fencing either on top of it or 2 feet from it on the outside should be a sufficient deterrent. A three-strand electric fence on its own, sloping inwards, is also said to be fox-proof.

Supplementary feeding

The amount of supplementary feeding required will depend on the amount and the quality of the grass available. Obviously, both the quality and quantity of grass will decline in the autumn, and then some feeding of growers' pellets and/or grain will be needed. Quicker growth will be obtained with pellets, but it is more profitable to feed grain as well. Hoppers of wheat and/or barley, and of course pellets, placed in different parts of the pens will give the birds a choice of food.

Data from the Ontario Department of Agriculture showed that geese fed outside in this way weighed nearly 12 lb at fourteen weeks of age, each having eaten 38 lb of food, more than half of which was grain.

Geese indoors

Farmers with Dutch barns or with buildings of a similar type to spare during the autumn may think it would be a lot easier to rear the geese wholly indoors. Very little information seems to be available on indoor goose production in this country. In the U.S.A. and Canada they are reared in this way, about 3–4 square feet per bird being allowed if they are kept to fourteen weeks. All pellet or pellet and grain feeding is practised there, but obviously the consumption of such bought-in foods is a lot higher than when the geese are on range. In Britain, with its moist climate, it should be possible to zero graze geese indoors, bringing short grass to them or even feeding them a silage made from short grass. This, together with grain and pellets, would seem to offer the best and cheapest indoor feeding system.

Indoor reared geese will have to be kept in pens of not more than about 200, and preferably no more than 100, per pen. Goslings kept indoors are extremely prone to down and feather pulling, and a simple form of beak trimming seems to be the best preventive treatment; only the 'bib' on the top beak needs to be removed.

Plucking and processing

Finally, a mention must be made about processing. Anyone contemplating large scale goose production will obviously have to organize this aspect of his enterprise. Plucking geese by hand is a laborious job, as anyone who has done it will be only too ready to agree, but if reliable featherers are available it is still probably the best and simplest method. Clean goose feathers can fetch up to 60p per pound; this means that the feathers from one goose can be worth up to 25p, giving an income which obviously can go a long way towards offsetting costs.

For really large scale goose production, however, mechanical plucking will have to be employed. Dry rough plucking by machine followed by wax dipping and stripping gives a really first-class finish to the geese and can be economic, as again most of the feathers can be sold.

Wet plucking can be successful with geese. The water temperature should be between 45° and 50°C and the length of scald about 2½ minutes. It is very important to see that the carcases are agitated either by hand or machine

when in the water tank so that the hot water can penetrate through the feathers to the skin. The use of a wetting agent is said to help.

After plucking, the geese can be eviscerated and packed in plastic bags and then deep frozen. If it is possible to organize the labour well, the birds can be processed in the week before Christmas and marketed fresh. Whichever method is used it is the carefully plucked and attractively presented bird which will command the highest price, so this part of the operation is worth doing well.

John Halliwell, N.D.P., is Divisional Poultry Advisory Officer with A.D.A.S. at Haverfordwest, Pembs.

Bull Licensing

New bull licensing arrangements came into force on 1st September 1972.

Bull licensing inspections are now to be carried out by veterinary surgeons in private practice who are members of a panel established by the Royal College of Veterinary Surgeons and the British Veterinary Association.

Farmers should apply for a bull licence at least one week before the bull reaches the prescribed age of ten months. The application should be supported and accompanied by a certificate as to the suitability of the bull for licensing, signed by a veterinary surgeon in private practice who is a member of the panel. An application form can be obtained from the veterinary practice. If the practice does not have a panel veterinary surgeon amongst its members, it may be able to put the farmer in touch with a practice which does. Failing this, farmers can obtain from the Ministry's Divisional Veterinary Officer a list of panel veterinary surgeons in their area. It is an offence to keep a bull over the age of ten months which does not have a licence or permit.

Under the new arrangements, if the panel veterinary surgeon certifies that the bull is sound, free of defects and healthy it will be eligible for a licence. Pedigree status in bulls generally, and standards of suitability for dairy bulls, are no longer grounds for refusing a licence. Cross-bred bulls are eligible for a licence.

The Agricultural Departments are retaining responsibility for the issue of licences, for arranging appeal inspections, for enforcement, and for dealing with applications for bull beef and special experimental permits.

Early potato lifting at Rosewarne E.H.S.

EXPERIMENTAL HORTICULTURE STATIONS

Seed Potatoes for Early Ware Cropping

B. H. Houghton

THE harvesting of first early potatoes, starts in the south-west of Britain and gradually extends northwards and eastwards as the season advances. Marketing begins as soon as the crop reaches about three and a half to four tons per acre, that is when tubers are over 1 in. in diameter and weigh between one and one and a half ounces.

The most successful seasons are those when the weather favours the south-west at planting time and no severe frosts follow the emergence of the crop. When growers further east have to wait for favourable weather, this is often to the advantage of growers in all areas as it allows a steady flow of potatoes to be marketed instead of a glut from all districts at once.

Apart from the major part the weather plays in shaping a successful season, the most positive influence the grower can bestow on the crop is to use correctly treated seed.

Seed production areas

The traditional areas of seed production are in the upland regions of Britain. It is widely known that this is because of the greatly reduced risk of virus diseases and soil borne infection carried over from previous ware crops.

During recent years, seed produced in the various upland areas of Scotland, Ireland, Wales and England has been the subject of experimentation at Rosewarne and a number of other centres. One main line of research has been to determine whether it is possible that one seed producing area produces better seed than other areas. By better seed is meant seed which has an in-built characteristic for producing earlier crops of ware. Various growers have asserted, both vocally and in print, that seed produced in early districts results in earlier crops. This had been an accepted fact for some time.

Workers at Edinburgh, Sutton Bonington and Efford have found that the effect of the location of the seed producing centre was small on the variety Arran Pilot. At Rosewarne, in a three year experiment, there was a trend indicating that an early planted Irish seed crop of Arran Pilot would give earlier ware yields than seed from a crop planted later. Scotch seed of this variety was generally slightly later than seed from other areas, the reason being attributed to the cooler growing conditions found in the Scottish seed producing areas. Yields from locally grown Cornish seed were good but not significantly better than other areas in two years out of three.

Early planted Irish seed of Home Guard did not have quite the same influence as it did with Arran Pilot. In fact yields from all sources of Home Guard seed were more uniform than with the somewhat unstable variety Arran Pilot. In a series of experiments at the Starcross A.D.A.S. sub-centre comparing North Cornish Home Guard with Irish, the results were in favour of the North Cornish seed. The good results obtained from seed grown in more southern latitudes can be attributed to the somewhat warmer growing temperature the crop receives and thus the progeny is more forward in its physiological development.

Research workers in Norway have recently found that the higher the altitude of the site of the seed crop, the later is the following ware crop. Again this supports the physiological development theory.

Physiological development

All seed goes through a period of dormancy between senescence and sprouting. In some early varieties this period is of long duration, e.g., Ulster Sceptre and Ulster Prince, while in others dormancy is short lived, e.g., Home Guard.

If the seed tubers of precocious sprouting varieties receive an undue amount of forwarding during formation, then senescence followed by dormancy will be early. Following a short period of dormancy the eyes will grow out early in a warm autumn and chitting may be too rapid. This can result in growth which has developed all its phases while still in the chitting tray. To do this it draws on the available nutrient within the tuber leaving very little reserve for root and stem development. All that remains to complete the cycle is the formation of new tubers which often occur prematurely in such forward plants. Because there is little root or foliage to support these tubers they remain small and low in number. The condition is described as 'little potato'.

It can be seen that the development of suitable seed for early ware production is governed by a series of temperature requirements.

Potato planting using home made tray carrier

Planting and growing

Once the seed crop has been planted, all depends on the weather which follows. In upland areas, planting must be timed so that emerging stems are not caught by late frost. If soil conditions are dry, this may be any time after the end of March, but in wet years may be delayed until May.

In Pembrokeshire many early growers arrange with hill farmers in Brecon and Radnor to supply seed. Experimental work in Wales has shown that the best early yield is grown from a seed crop which is chitted before planting in early April.

The optimum time for burning off is more generally in the third week of July, rather than in August. Thus there is a fifteen or sixteen week growing period for the seed crop.

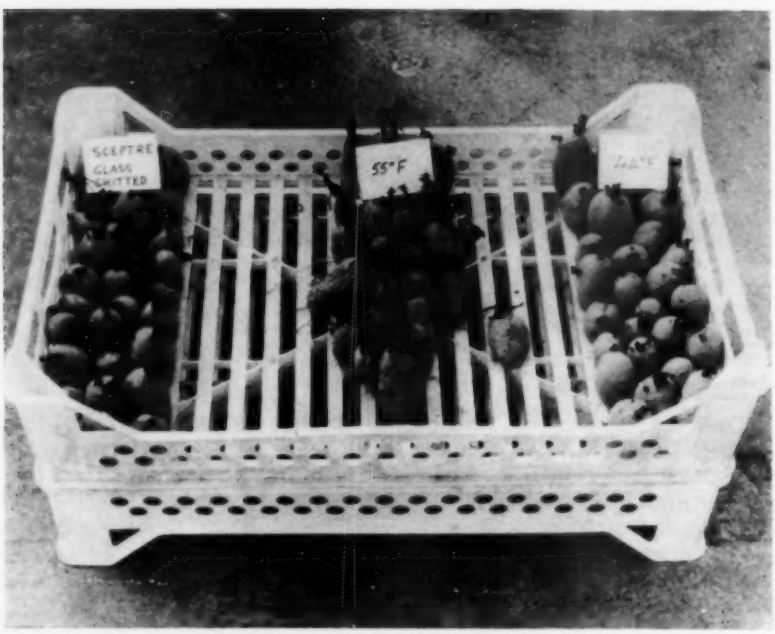
At Rosewarne E.H.S., at an altitude of 200 ft and in a maritime climate, a similar timetable is also used and found to be satisfactory for the production of all seed potatoes used at the Station. Earlier planting than this would cause precocious development in Home Guard and Arran Pilot. Burning off is carried out in mid-July when a satisfactory crop of seed-size potatoes has formed. This also prevents blight from affected foliage reaching the tubers.

In order that the crop shall be of seed-size tubers, it is planted between six and nine inches apart in rows twenty-eight inches apart.

Time of lifting

An experiment to determine the best time to lift seed crops of early varieties has been completed for the second season at Rosewarne E.H.S. The three varieties, Home Guard, Craigs Royal and Ulster Sceptre were lifted on four dates between early August and early November, followed by sprouting trials in a number of different buildings between November and March. Two seasons results have been inconclusive with Home Guard, but with Craigs Royal and Ulster Sceptre higher yields have come from seed which was lifted in either August or September.

With Home Guard being such a precocious sprouter it is often difficult to hold back growth so that it can be handled easily at planting. By keeping the seed crop in the ground until late October, eventual sprout length is much reduced compared with that produced on earlier lifted seed. Lifting Home Guard in August increases sprout length and the risk of 'little potato'. Such seed tubers will nearly all be single sprouted due to the apical bud 'breaking away' from the others early on.



Ulster Sceptre sprouted in different environments

Storage buildings

The building used for sprouting should be capable of being kept at a low temperature, but at the same time some form of frost prevention is essential. In early producing western districts stonewalled buildings are common and many are adapted for potato chitting. The thickness of the wall and presence of few windows keep the temperature cool and short periods of low outside temperature do not impose upon the interior of such buildings. Likewise,

rises in temperature take time to affect the inside of the store. The use of tubular fluorescent lights hung at intervals of 7½ ft along the alleyways between the stacks of trays ensures that sprout development is kept short and green.

Many glasshouses are still used for chitting potatoes, but there are fewer being erected now than twenty years ago. The reasons are several—the cost is higher than a brick or block building, maintenance is more costly and temperature differences occur between top and bottom of stacked trays. However, if double doors fitted at either end of the house are kept open during day time the mean temperature can be kept below 10°C between November and early March. Obviously the light factor is very good and unless trays are stacked too closely strong green sprouts can be produced on all tubers.

The two types of building just described are perfectly adequate in which to sprout seed of all varieties requiring similar temperature treatment for general early cropping in a first early district.

Comparison of haulm on Ulster Sceptre following sprouting at 6·7°C (left) and 12·8°C (right)

Temperature controlled stores

The meticulous grower who has fields of very early potential—south sloping, sheltered and/or near the coast—may want to exercise more precise control over his seed.

It has been shown at Rosewarne E.H.S. that varieties vary considerably in their cropping when kept at different temperatures. Home Guard for

example, is higher yielding when overwintered at 7·2°C, Craigs Royal can with advantage be kept at 10°C, while Ulster Sceptre is low yielding following storage at 12·8°C but doubles its yield at 6·7°C. However, with most commonly grown early varieties tuber numbers per plant are reduced at between 10 and 15°C temperatures but the weight of individual tubers increases. Although it is desirable to produce a crop of maximum size potatoes, it is often more economic to produce a higher yield of slightly smaller tubers.

Precise temperatures can be maintained by automatic control of ventilation as store temperature rises. Provision can also be made for extra cooling by refrigeration to a base level just below 4°C. If extra heat is required, this is usually provided by oil-fired warm air heat exchange units or simply by electric heaters. In a well insulated building near the coast, heaters could be dispensed with if the variety required no greater heat input than 7·2°C, e.g., Home Guard. The provision of fluorescent lighting itself generates a certain amount of heat.

Obviously a purpose built store will cost more than using an existing farm building, so it seems sensible to allocate such a store to that fraction of the crop which can be lifted really early when returns will be more economic. The remaining crops from slightly later high yielding varieties may be sprouted in a cheaper type of building.

Automatic planters

With the use of high speed automatic planters, the storage and handling of seed requires control not only for maximum yield and earliness but also for length and number of sprouts which can be handled easily by the mechanism of the planter. Sprouts should not be more than 1½ in. long, otherwise they may impede the flow of tubers through the machine. Multi-sprouted tubers are preferable to singles as an insurance against mechanical damage. The length of sprout per tuber is roughly proportional to the number of sprouts it has to support and the ideal number on early varieties is two or three. More than this will give a high density of stems and a crop of small tubers.

The flow of small seed through the planter is more uniform than large seed; therefore careful grading of seed before chitting is needed. For the grower who grows his own seed, careful timing of burning off and correct plant density will go a long way towards achieving the optimum size of tuber. Automatic planters save considerable time but results can be jeopardized by poor management of seed.

B. H. Houghton, C.D.H., is a Horticultural Advisory Officer at Rosewarne Experimental Horticulture Station, Camborne.

Information about Milk and Milk Products in the E.E.C.

A further leaflet entitled Milk, Milk Products and the E.E.C. has been published in a series being produced to explain the implications of entry into the European Economic Community for various sections of the agricultural and horticultural industries. This gives broad outlines of the Common Agricultural Policy and the transitional arrangements as they affect milk and milk products.

Single copies of the above leaflet may be obtained, free, from the Ministry of Agriculture, Fisheries and Food, (Publications), Tolcarne Drive, Pinner, Middlesex, HA5 2DT.

Anthurium for selection and seed production

Pot Plant Study Tour of Holland and Belgium

W. G. Hume

ON this tour of Holland and Belgium to study pot plant production, visits were made to Research Stations, markets and glasshouse nurseries. I was extremely grateful to the numerous people with whom I made contact for their kindness and courtesy. The nurserymen particularly were very co-operative and freely discussed their crops and cultivation methods and on several occasions I was told, 'We have no secrets on this nursery'.

Specialization

On a tour of this kind it is natural that arrangements are made for visits to the larger and more important nurseries. One gains the impression of magnitude, but cannot fail to be impressed by the skill of the growers in cultivating plants of the highest quality, and by the high degree of specialization in the production of a limited range of crops on individual nurseries.

To give an example of cropping on one of the larger nurseries in the Aalsmeer district of Holland where the main business is the production of

ferns and pot plants, half a million Reiger begonias are raised annually from leaf cuttings, mainly Schwabenland Orange and Schwabenland Rose, followed by 400,000 stem cuttings of winter flowering begonias. Four million young cyclamen plants are raised for sale each year and 10,000 of these are selected and grown-on for seed production following careful hand pollination at flowering time. Poinsettias, mainly Annette Hegg and sports, are exported as young plants and about half a million are produced. In addition to 300,000 pelargoniums, two million ferns of different kinds are grown and, as growing and selling agents for Holtkamps of Germany, between two and three million Rhapsodie saintpaulias are distributed every year.

Other nurseries are equally specialized, one growing only aphelandra, begonia and dieffenbachia, another anthurium and azalea indica. On this latter nursery 900,000 azaleas, with a target of one million, are raised from cuttings each year. These are taken in July and are ready for sale as flowering plants by December of the following year. There is a big demand for these smaller plants which sell more cheaply than larger grafted azaleas.

A number of specialist growers are in association with others who also specialize, some with ferns, others cyclamen, begonia etc., and together they work co-operatively in producing and selling a wide range of pot plants. These are collected from associate nurseries and placed in big bays in a central glasshouse for making up consignments to meet wholesalers' requirements at all seasons of the year.

The highest degree of specialization was seen on a Belgian nursery where the whole glasshouse area of 2½ acres was made up of raised beds, every one of

Hedera Gloire de Marengo

which was full of hedera, 'Gloire de Marengo'. They were growing in all stages of development from propagation to mature saleable plants; over half a million plants were in clay pots plunged in peat and leafmould in the raised beds. This nursery is being extended to meet increasing demand.

In Belgium generally, there was a greater emphasis on house plants, the nurserymen specializing in a few subjects only. It was astonishing to see the extensive production of plants like philodendron, maranta, ficus, dracaena, croton, aralia, dieffenbachia, sausevieria and peperomia. The most surprising aspect, however, was the enormous scale on which bromeliads and anthurium were being grown on many nurseries for export to all European countries and Scandinavia. One grower who concentrated largely on these two groups of plants made frequent deliveries in his own vans to Germany, Austria and Italy.

Production

On all nurseries, glasshouses were full to capacity. In most of them shelves had been erected to give two-tier cropping and the plants were grown in clay pots plunged up to their rims in oak leaf-mould and peat in raised beds. This reduced the need for frequent watering and it was apparent that clay pots were preferred to plastic pots for this system.

Lochristi, a few miles from Ghent, is the centre of the Belgian azalea industry; 380 nurseries in that area specialize in the production of azalea indica, although many are concerned also with the important Belgian begonia industry.

Fairly successful results can be obtained by raising plants of varieties of azalea like Paul and Eri Shaeme, Hexe and Eclairuer from cuttings. Quantities of these are grown from cuttings and sold as 6–9 inch diameter plants, but even these are better grown as grafted plants along with varieties like Vervaeneana sports, Salmoneum, Pink Pearl, Madame Petrick and others. Grafting is done during April and May, and after stock and scion have united the plants are planted in beds of peat and decomposing pine needles on the floor of the glasshouses. Here they are grown until the year of sale, usually the second or third year of cultivation, when they are plunged out of doors in raised beds made up with compost bought-in each year. This consists largely of leaf-mould and decomposing pine needles collected from the forests on the Belgian, Holland borders. On the nursery visited, £2,000 is spent each year on purchasing compost of this type, an expenditure regarded as absolutely essential in the interests of hygiene.

Both the Lochristi and the Melle areas near Ghent are noted for their large quantities of begonias, but the majority of the nurserymen are concerned with the production of tubers for sale rather than with flowering plants. Melle is the most important centre and in this area alone there are about 700 nurseries raising begonias, many of them family concerns. They produce about eighty million tubers a year, 80 per cent of which are exported to E.E.C. countries and to Britain and the U.S.A.

Marketing

In Holland and Belgium the excellent market arrangements and the efficiency of market organizations are facilities indispensable in all areas of intensive production. In 1971, the annual turnover of the two flower auction

markets at Aalsmeer, the Centrale Aalsmeerse Veiling for pot plants and the Bloemenlust for cut flowers, was over 190 million guilders, and between the two markets there was a membership of 2,770. Exporters operating from these markets have connections in all parts of the world, the most important countries being West Germany, Switzerland, France, Britain, Belgium, Austria, Italy and Scandinavia.

In 1968 it was decided that the covered part of the CAV auction market of six acres was too small for the increasing throughput, and arrangements were made for a new cut flower auction market to be constructed on a new 100-acre site. Work started in 1969 and the first auction was held in February 1972. The huge new auction market building covers 21 acres and is being used entirely for marketing cut flowers. The old buildings of the CAV are being placed entirely at the disposal of the pot plant auction market.

In Belgium, the large Co-operative Flower Market at Wetteren has 1,200 members. All produce is sold on behalf of members by the market organization, the grower being charged commission on all produce sold. The market organization supplies sixty-three foreign customers in most of the continental countries and has in addition a few outlets in Britain. One senior marketing officer organizes the sale of pot plants; to enable him to plan ahead, growers must inform him every two months what plants they will have available for the following two months. He is responsible, also, for ensuring that a high standard is maintained in the quality of plants for dispatch and he makes frequent visits to nurseries for this purpose. In addition to direct sales, pot plants and cut flowers are sold at two clock auctions in this market where there is accommodation for 150 buyers. These are but two examples of the organized co-operative marketing arrangements for flowers and pot plants in the two countries.

Research

Differing from research activities in Britain, in both Holland and Belgium research stations have been set up exclusively for flowers and ornamental crops. The very modern Research Station for Floriculture at Aalsmeer was built about six years ago, replacing an older station in the town centre. Advantage was taken of the opportunity to plan the layout of the new laboratories and glasshouses at the outset. The glasshouse unit has been erected in blocks with the glasshouse partitioned in sections extending right and left from a very wide central glass covered corridor.

The research programme covers a wide range of glasshouse flowers and pot plants, bromeliads, anthurium, azalea, aphelandra, cyclamen, streptocarpus and gloxinia being some of the plants on which important research is being carried out. In addition there is an extensive programme of research in which carnations, chrysanthemums, roses, freesias and gerberas feature prominently. Work with bedding plants is receiving attention also. This station is doing extremely valuable work and much useful information is being disseminated by the State Advisers.

In Belgium, the main objectives of the Government Research Station for Ornamental Plant Growing at Melle are research on breeding of flower crops and ornamentals and the improvement of their production methods and marketing. It is not surprising that the activities of the station are concentrated to a large extent on azaleas and begonias and in the 1½ acres of glasshouses these crops were very much in evidence. Azalea indica is of out-

Azaleas—2 year old grafted plants

standing economic importance to the flower growing industry of Ghent and, in addition to breeding work, experiments are continuing into the study of chemical pinching to find suitable concentrations of methyl nonanoate and methyl decanoate according to the variety, size of plant and other factors such as glasshouse temperature. It is estimated that if all Belgian azalea growers could change from hand pinching to chemical pinching once a year, 100,000 hours of labour could be saved.

Future Programme

Tuberous begonias are of equal importance and the breeding programme is aimed at uniformity of flower colour, improvement of flower form and sturdiness of stem. The family Bromeliaceae claim a fair amount of attention. Selections from crosses made within the genera Aechmea and Gusmania are being grown-on for multiplication and several Aechmea species have been imported to obtain new genetic material. Other station activities relate to a range of house plants, rose breeding and rose growing techniques and much work is being carried out with several kinds of ornamental nursery stock.

Horticultural education

In both countries, but especially in Holland, there is a tremendous emphasis on horticultural education, not only through the Research Stations and Experimental Horticulture Stations, but also under the guidance of the Government Horticultural Advisory Board, through the Horticultural Schools, both at elementary and secondary levels. This has encouraged an awareness of the profound importance of horticulture amongst all those engaged in the industry, and the desire to become experts in certain fields of horticulture has led to greater specialization.

The State Horticultural Advisers, too, are absolute specialists and have amassed a vast amount of data on every aspect of their subject. They specialize in a very small group of crops, some advising on pot plants, others on cut flowers. The title Glasshouse Specialist of the Agricultural Development and Advisory Service in this country is too all-embracing and much too wide a term for their comprehension.

It is impossible in the space of a short article to deal with all aspects of what was a very full and comprehensive tour of the main pot plant growing areas. But this summary will emphasize the importance attached to the horticultural industries of both countries visited.

W. G. Hume, N.D.H., was Regional Horticultural and Glasshouse Advisory Officer with A.D.A.S. at Wolverhampton.

Ministry Publications

Since the list published in the September issue of *Agriculture* (p. 402) the following publications have been issued.

FREE ISSUES

ADVISORY LEAFLETS

No. 17 Swine Erysipelas (Revised)
No. 42 Codling Moth (Revised)
No. 61 Pea, Bean and Clover Weevil (Revised)
No. 225 Cutworms (Revised)
No. 307 Root-Knot Eelworm in Glasshouses (Revised)
No. 365 Houseflies, Blowflies and Clusterflies (Revised)
No. 414 Eelworms on Strawberry (Revised)
No. 422 Hand Cleaning and Sterilization of Farm Dairy Equipment Using Chemicals (Revised)
No. 430 Broiler Production (Revised)

SHORT TERM LEAFLETS

No. 143 Grassland Practice No. 3 Zero Grazing (New)
No. 144 Insects and Crop Pollination (New)

Single copies of free items are obtainable from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex HA5 2DT.

Upland scene near Ruthin, Clwydian range in the background

13. Denbighshire

Tom M. Telford

For scenic beauty and variety, Denbighshire (Sîr Ddinbych) bears comparison with any area in Britain. With about twelve miles of coastline on the Irish sea to the north occupied largely by the busy resorts of Colwyn Bay and Abergele, the county extends inland along the Conway Valley to the mountainous border with Merioneth. To the north east, the boundary with Flintshire runs through the Clwydian Range and, to the south and east, the River Dee forms the border with the Cheshire and Shropshire lowlands for a considerable distance. Mynydd Hiraethog (Denbigh Moors) is an extensive area of bleak moorland at 1,200 ft to 1,800 ft between the Vale of Conway to the west and the Vale of Clwyd nestling below the Clwydian Range to the east.

The Dee, Clwyd, Conway and Ceiriog Valleys form a large proportion of the highly fertile, lowland areas of the county while the moors and mountains,

thickly forested in some areas and including the large Clocaenog forest of about 15,000 acres, provide a sharp contrast both in scenery and agricultural productivity.

Tourism is important in many parts of the county but industry is not except in the industrial area of East Denbighshire which has Wrexham on its eastern fringe. Here coal mining, steel, brick making, chemicals, leather manufacture and brewing are important, together with the interesting post-war development of the Wrexham Industrial Estate based on a variety of light industries.

Soils and rainfall

Soils in Denbighshire are formed from three parent materials. In the Vale of Clwyd they are largely derived from Triassic boulder clay and are mainly imperfectly drained soils of the Cottam series, but with some areas of light freely drained soils derived from Triassic drift. To the west of the Vale and south west of Llangollen, Silurian shale is the parent material, and soils vary from Podzols in the upland to shallow, sedentary, free-draining soils and silty, imperfectly or poorly draining soils in the lower areas. In the Wrexham area they are derived from carboniferous parent materials and vary from light sandy soils similar to the Newport series, through medium textured brown earths to heavy silty poorly drained soils with a weak structure. Rainfall varies greatly; over 70 inches a year is recorded in the highest and most westerly areas but under 25 inches in some localities in the valleys of the Dee and Clwyd which are well sheltered by the mountains from the rain-bearing westerlies.

The agricultural scene

Soils, rainfall and topography allied to a mild climate provide ideal conditions for a farming pattern based on grass. Of about a quarter million acres of crops and grass some 88 per cent is permanent and temporary grass with about 122,000 acres of rough grazing in addition. Grazing cattle and sheep form the backbone of agricultural production in the county, although cereals and other cash crops, mainly on large farms in favoured areas, are important. It is estimated that there are now about 1,660 holdings providing full-time employment for the occupier; a large majority of these are family units of between 50–150 acres. Larger holdings number about 400.

Dairying is by far the most important single enterprise. Although the number of producers has decreased steadily from over 3,000 in 1950 to about 1,420 in 1971 cow numbers have dropped only slightly and milk production has increased in recent years with almost twenty-eight million gallons being sold in 1970/71. Sheep, which are numerous in the county with about 350,000 breeding ewes, are of particular importance in the uplands. Systems vary, from pure Welsh self-contained flocks on the higher farms producing draft ewes and fat or store lambs, to flocks based on ewes bought from harder areas and crossed with Suffolk or other Down rams for fat lamb production. The Welsh Half Bred has established itself in recent years with the annual sale at Llangollen, renowned site of the International Musical Eisteddfod held each year in July.

In the uplands, the traditional pattern of a small dairy herd coupled with livestock rearing persists strongly on many of the smaller farms. Systems

based entirely on livestock rearing are usually to be found only on the larger farms.

Trends

The pattern of family farming will continue, but change from traditional systems, although relatively slow, is gathering momentum. In lowland areas there is increasing specialization in milk production, with herd size increasing and with a change to loose housing usually cubicles and parlour milking. The number of parlours has increased from 23 in 1960 to 159 in 1971. In upland areas, the decline in dairying is fairly rapid. This is often associated with farm amalgamations and with the formation of units big enough to rely on livestock rearing systems. Beef breeding cows are increasing quite rapidly and now number about 16,000. The calves are sold in the autumn or as stores in the following spring, but increasingly they are fattened on the farm if circumstances permit.

Adoption of modern methods of grass conservation has accelerated in recent years, associated with the provision of modern buildings. Barn hay drying has given good results on some farms but fully mechanized silage-making continues to find favour.

Co-operation and marketing

Formal co-operative activities have developed in recent years. The Hiraethog Lamb Group was formed in 1968 and now forms part of Welsh Quality Lamb Limited, an organization responsible for the seven Lamb Groups in the Principality. In conjunction with other counties in North Wales, the Denbighshire Welsh Mountain Sheep Society has carried out performance and progeny testing of Welsh Mountain rams for some years in a determined effort to improve the quality of hill flocks. Five pig weaner groups are also operating successfully. Informal co-operation between friends and neighbours is strong in Denbighshire, particularly for shearing and at harvest time. Apart from these groups and private selling, marketing of stock is largely through the six auction markets in the county. Prices of fat, store and breeding stock have been good recently, with demand from the large urban populations and the intensively stocked dairying areas of Cheshire, Staffordshire and Shropshire only a short distance away.

In connection with Denbighshire, a mention of my famous namesake Thomas Telford (1757–1834) is appropriate. The Menai Suspension Bridge is well known but the Pontcysyllte Aqueduct near Llangollen is perhaps his masterpiece. 'The stream in the sky' as Sir Walter Scott described it carries the Llangollen canal over the Dee. A brief detour from the A5 and a walk over the Aqueduct will be extremely rewarding for any visitor.

★ ★ ★ ★

in brief

- **Selling in the Common Market**
- **Rats, mice and abnormality**
- **Watch on the elms**

Selling in the Common Market

TODAY's high productivity of British farming has been achieved by its sheer technical competence, progressive mechanization and an adaptability on the part of its greatly reduced labour force to new concepts that are but inadequately described as 'winds of change'. To this extent, therefore, the shadowy fears expressed in some quarters concerning Britain's entry into the Common Market can be dismissed. Nevertheless, the fact that we are entering a new era in our political and commercial history requires that we examine closely the strategy by which our new opportunities in a vastly expanded 'home' market will be realized. Only in one sphere, it is generally conceded, have our European partners-elect the edge over us, and that is in really efficient marketing; and as technical advances continue to be made on the Continent, our own farmers and growers will assuredly have to face keen competition. It will be to *the market* rather than to the Government that they will have to look for their return. This implies a full knowledge of the vicissitudes of consumer demand and preferences, and close involvement in the E.E.C. organizational methods specific to each of the major commodities. A comprehensive marketing intelligence network is therefore seen to be a fundamental necessity to ensure that British farm products home on to their markets with lasar-beam accuracy and, having won them, hold them by continued reliable service and flexible adaptation.

All this implies the need for strength in our producer organizations—a fact of life which has already been well and truly learned abroad, particularly in Holland, France and Denmark. The history of co-operative development in Britain has not hitherto been marked with wild enthusiasm, reflecting perhaps a long ingrained, yeoman-like spirit of independence. But there can be no doubt that the increasing interest now being shown in many facets of farming and horticultural co-operation will have to gather pace and coalesce, so consolidating producer ranks to present a strong competitive front. Mr. Herlitska, Secretary-General of C.O.P.A., gave some figures recently estimating that in the E.E.C. countries a million people already work for agricultural co-operatives, of whom 600,000 are paid employees; also that there are about twelve million members in some 50,000 co-operatives, and of these over 20,000 are engaged in marketing.

In short, it is to a more organized marshalling and use of our substantial resources that we have to look as we stand upon the threshold of entry into the E.E.C., bearing in mind that our partners will also be our competitors.

Rats, mice and abnormality

THE prefix 'super' appears to be getting too strong a hold on the English language. We live in a supersonic age, shop at supermarkets, accept superlunary adventure as commonplace and stimulate the young with the exploits of supermen. Perhaps some sections of the press may be excused therefore for their references from time to time to 'super-rats' and 'super-mice', following an acquired resistance by some

of these rodents to certain commonly-used rodenticides, notably warfarin. It might indeed be supposed by the more imaginative and less knowledgeable of their readers that here was something akin to escapes from the fantasies of scientific fiction, whereas in fact such resistant individuals are in no way dissimilar in size from others of their species, nor is there any greater risk of their spreading disease than at any time hitherto.

It was in 1952 that warfarin first came into use as one of a number of anti-coagulant compounds, and over many years it has put into the hands of farmers an effective measure of control. The discovery nine years later of a genetic resistance among individual members of certain rat populations in Shropshire and the Welsh border counties, and subsequently of mice, is merely another example of nature's law of survival. We have seen a similar reaction with the rabbit against myxomatosis and red spider mite defence against specific chemicals, to quote only two examples. In neither case were super-rabbits or super-mites produced!

That new chemicals to control rats and mice will be introduced is not in doubt, and to this end the Ministry's Pest Control Laboratory has been collaborating with the chemical and pharmaceutical industries. Laboratory tests have been succeeded by field tests, but until the potential of the new formulations has been fully explored, the immediate answer to rodent control must be a change of tactics —switching to other toxic rodenticides, such as zinc phosphate and, where environmental temperatures are not higher than 18°C, alpha-chloralose. Though perhaps more troublesome to use, these poisons are effective, and in a determined effort to clear rodent infestations from farms could advantageously be reinforced by skilfully placed traps. As it happens, moreover, evidence is accumulating that warfarin-resistant animals are less fertile than their susceptible fellows, so that alternative methods of killing could now be most timely.

Not least, the old axiom that prevention is better than the cure should be borne in mind; it is certainly a lot cheaper. Rats and mice, like every other form of life, are looking for the right environment in which to set up their colonies—cosy lodging and an abundance of food ready to their needs. Deny them these in granaries, barns and feed stores, rubbish dumps and old sacks, and by careful disposal of food residues, and they will not be encouraged to start what is on some farms already an unscheduled 'enterprise'.

Watch on the elms

PROLONGED and unabated vigilance is essential if the elms of England are to survive the particularly virulent fungus disease which two species of elm bark beetle are spreading. Their breeding grounds must be destroyed as the primary measure of their control, so that identification of affected trees is fundamental. But this does not imply panic felling, since early detection and perhaps remedial surgery of affected branches can often save the tree. Foliage colour changes in the autumn are not necessarily symptoms of elm disease and should not therefore be used for disease identification; and this point is emphasized in the Forestry Commission's latest leaflet* on the subject, which all landowners and farmers would be well advised to read and indeed publicize, particularly in southern England where the disease is most prevalent. 'With experience, however', says the Forestry Commission, 'a diseased tree can also be recognized after general leaf fall. Signs to look for are 'shepherds' crooks' on the main shoots and the absence of fat, healthy winter buds.' When these observations suggest infection, inspection of the bark for beetle larvae in their tunnels is the next step, looking also for beetle exit holes which give the bark the appearance of having been peppered with small shot.

The current recommendations are that sanitation felling should normally be restricted to dead trees and those in which more than half the crown has been killed. More lightly affected trees should be given the chance to recover.

AGRIC

*No. 54. The Control of Dutch Elm Disease. H.M.S.O price 6p (by post 9p).

Books

The Biology of Lactation. G. H. SCHMIDT. W. H. Freeman, 1972. *£3·80.*

In the preface to this book Professor Schmidt writes: 'This book is intended to serve as a textbook for students of the physiology and bio-chemistry of lactation and as a general reference book for research workers in this field. This is an attempt to bring together the pertinent and the most recent literature on lactation'.

Biology of Lactation does just this, and more. For some long time now there has been a real need for an authorative book on this subject, so it is not only timely, but can be recommended to an even wider readership than that envisaged by the author. Extension workers, dairy farmers and those concerned with the milking and management of the larger dairy units will also benefit. Although the book covers an extremely wide field, it is written by someone who is as well versed in the fundamental work as in its application. For the student who wishes to know all about mammary gland anatomy, histology and cytology he will find this book informative and well illustrated; and for further reading a comprehensive list of references is given at the end of each chapter—of which there are sixteen. This makes the study of any particular aspect of a wide subject extremely easy and dispenses with the need to search through the full text for appropriate details.

The list of contents set out very clearly the many different facets of the subject covered. A summary at the end of each chapter is of particular value to students who of necessity have much reading to do during their course of studies.

On the more practical side such matters as milk secretion rate, milking rates, factors affecting the yield and composition of milk and udder abnormalities are all dealt with most fully, and are well worth detailed study and application.

The book is well planned, logical and most readable. It has come at a time when technological developments on dairy farms are such that a better understanding of the biology of lactation is essential for all those whose job is concerned in many ways with the dairy cow. *B.T.*

Land Use. D. R. DENMAN and SILVIO PRODANO. George Allen and Unwin, 1972. *£4.*

The book expounds a new philosophy of land use the core of which is the presentation of a mode of analysis which enables the planner to identify, by reference to defined standard forms, the nature and attributes of the ownership unit within which the landowner takes his decisions for land use. The analysis goes further to facilitate the study of motives and of the relationship between different forms of wealth, fixed assets and the land, in the make-up of the landowner's plans for the use of his resources. Behind the analysis is the simple notion that the use of land is decided by those who own it and only those in possession of property rights are capable of positive decision-making over land and land resources. The implications of this philosophy are far reaching.

A distinction is drawn between the positive power of property rights and the negative power of the planner; a situation which has given rise to the unsatisfactory position in this country and in the western world generally where the planner is denied the power of positive planning and the holders of property rights are discouraged from the exploitation of the power which is theirs. The suggested remedy lies in bringing the proprietary land unit into the planning process. How this is to be achieved in this country at the present time is not too clear for we lack a record of proprietary interests in land. This is not, however, the case with certain European countries, including some members of the E.E.C.

The analysis has a universal relevance irrespective of social order, economic philosophy and judicial systems. The book concludes with an illustrative study of the application of proprietary land use analysis which exemplifies some of the concepts expounded in the theory.

The work suggests that proprietary land use analysis is of immediate relevance to cost benefit analysis because in any actual or proposed land use pattern it identifies the points where motives can be discerned and true benefits and actual costs made known. An investigation pursued on these lines would require the investigator to identify the proprietary land units and the holders of them and assess costs and benefits from their points of view. It is claimed that an assessment made in this way would be more realistic than one produced by current cost benefit analysis techniques which by their very nature tend to be based on value judgments rather than actualities. The problem of how to value rural land in the context of

cost benefit analysis is well known. The proprietary land use analysis approach might well go a long way to providing an answer which will give to rural land a more convincing value in relation to the other factors in a cost benefit analysis than for example the relatively small figure which appears in the report of the Commission on the Third London Airport. The sooner this new approach is tested in relation to rural land and rural amenity the better.

P.J.H.

Soils of the Melton Mowbray District. A. J. THOMASSON. Soil Survey of England and Wales, 1971. £2.

This book describes the soils of northern Leicestershire and southern Nottinghamshire (Sheet 142) covering an area of 216 sq. miles, which includes the Wreake Valley, parts of the Soar Valley, the Vale of Belvoir and the intervening plateaux. This was traditionally an area of grassland and grazing livestock but in response to technical and economic pressures has now become an area of mixed farming, with cereals as the dominant arable crop. The early chapters are devoted to a general description of the area, including geology and climate, and an introduction to the soils, soil survey methods, soil forming processes and soil groups. The main section naturally deals with a detailed description of the soil series, twenty-six of which are recognized in the area, mapped in twenty-seven units. Soil profiles are well presented in tabular form and the major soil series are described in considerable detail, particularly in relation to parent material, texture and lithology, structure, colour, occurrence and variants, and drainage. Chapters on soil water regime and land drainage are of particular practical importance and a table showing the normal drainage requirements of the various soil series and complexes in relation to depth and spacing of underdrainage and permeability aid is of considerable interest. The final chapter deals with soils and agriculture and covers annual cultivations and poaching, soil nutrients and lime, and land capability.

The book is attractively produced and well illustrated with tables and diagrams. The soil and land use capability maps in the back pocket are in colour and add to the value of the book, which should be of interest not only to agriculturists but also to planners concerned with land use in the area. The book may be obtained from the Soil Survey, Rothamsted Experimental Station, Harpenden, Herts.

S.E.T.

The Farm Business. L. NORMAN and R. B. COOTE. Longman, 1971. £2·50.

The book is probably the most comprehensive and readable text on basic farm management since the appearance of *Farming for Profit* by Dexter and Barber ten years ago. Although the authors have written the book primarily to cater for students and teachers concerned with the City and Guilds syllabus, it will nevertheless be a useful addition to the farm office bookshelf.

The book seems to fall into two halves, the first of which deals with basic techniques such as farm business analysis, budgeting, and discounted cash flow and also includes chapters on fixed costs, economics, and capital. The second half is devoted to enterprise studies, and past questions from City and Guilds examinations with answers.

The chapter on analysis of the farm business introduces a series of work-sheets which can be used to calculate the usual performance and efficiency factors from the trading account. This system will be particularly useful when the Farm Business Recording Scheme has ceased to exist because it provides a standard 'do it yourself' method for farmers to calculate their own results.

Complete budgeting, partial budgeting, and break-even budgeting are dealt with in a clear and logical manner giving some useful basic rules to be followed and using realistic examples. The chapters on fixed costs and capital also give excellent cover of their subjects which include labour, machinery costs, balance sheet analysis, discounted cash flow, sources of capital, rules of borrowing, credit facilities, and capital planning.

The chapter on economics gives a very concise account of the principles of supply and demand, diminishing returns and marginal returns. This should give the student or farmer a better understanding of the forces affecting farming businesses.

The subjects of budgetary control, cash flow, and enterprise recording schemes seem to have been neglected throughout the book. The brief mention given to Work Study in the chapter on fixed costs is so brief that it might well have been omitted completely.

The enterprise studies in the second half of the book are very comprehensive and cover all aspects of each enterprise in turn. These studies have, however, been padded out with technical information which would have been better left for technical publications on each enterprise rather than included in a book on the farm business generally.

B.S.H.

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AGRICULTURE

Publication of the Journal will cease at the end of this year. In its place, the Ministry will publish a new monthly journal which will carry news and explanation on all aspects of the Ministry's responsibilities—food, agriculture and fisheries—the most important of which will be on E.E.C. directions and regulations. It will include articles and statistical information of interest to all elements of the farming, food and fishing industries.

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Ministry of Agriculture Fisheries and Food

Selected Bulletins

Diseases of Vegetables

Each vegetable is taken alphabetically and the diseases likely to attack it are described. Control measures are also given.
(Bulletin No. 123) **62½p** (69p)

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The bulletin deals with many important developments in spraying machinery, equipment and materials, and the corresponding changes in the spraying techniques with fruit trees. Illustrated.
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(Bulletin No. 48) **62½p** (69p)

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A list of agricultural and horticultural titles is available free on request from Her Majesty's Stationery Office, P6A, Atlantic House, Holborn Viaduct, London EC1P 1BN
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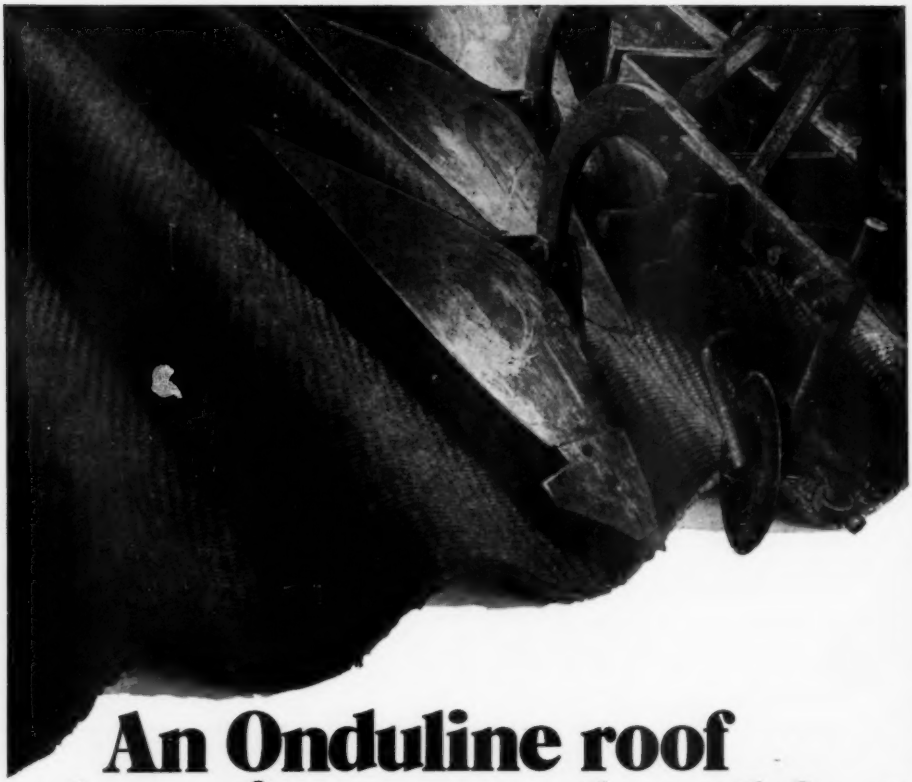

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